Charles F. Hunt

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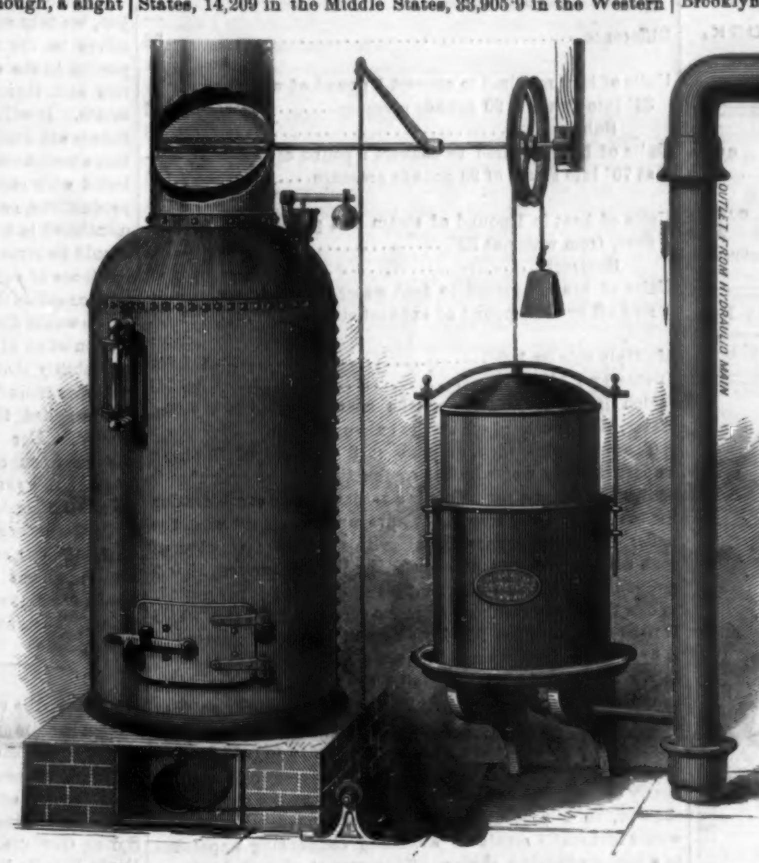
AUTOMATIC FIRE GOVERNOR FOR GAS WORKS.

The invention illustrated in the annexed engraving consists in a common gas governor, connected with the outlet of the hydraulic main, and also with the dampers in the chimney and under the fire. The arrangement is such that as soon as the engine does not exhaust fast enough, a slight pressure, being left on the retorts, is communicated to the governor, causing the latter to rise, thus opening the dampers at both of the above named points, and putting on all draft until the requisite speed is obtained. The pressure then being removed, the drum descends, closing the dampers, and preventing the fire making more steam until a future supply is once more required.

The disposition of the simple mechanism is clearly shown in our illustration, so that detailed reference to the various parts is unneeded. It will be seen that, as the governor is controlled by the pressure of gas on the hydraulic main, the amount of steam will vary, according to the make of gas—whether it be ten, fifty, or a hundred pounds—and all without any attention on the part of the men, except to replenish the fire.

The Yonkers (N. Y.) Gas Light Company have had the apparatus in successful operation for several months past, where it can now be inspected. It is claimed to dispense with the engineer in many places, besides performing his work in a better manner; to save fuel, as burning to waste is prevented; to preserve the boiler, since the door need not be opened except when the fire requires renewal, and to obviate the use of compensators and engine governors.

The invention was patented through the Scientific American Patent Agency, August 4, 1874, by Mr. James Slade, of Yonkers, N. Y., who may be addressed for further information.



SLADE'S AUTOMATIC FIRE GOVERNOR FOR GAS WORKS.

IMPROVED COAL SCREEN.

The invention which we illustrate herewith will be found a very convenient device for use in coal yards, since it allows of the separation of the coal from the adhering dust and small particles with much less trouble to the workman than is necessitated in employing the ordinary screen. It consists of a box having an inclined open front portion for the reception of the screen, which last is supported by the projecting ends of its side pieces resting against the bottom portion of the box, while its upper part is sustained by levers, A. These levers are pivoted to the side walls of, and inside, the box, and are adjustable so that the screen may be inclined to any angle, as required by the quality and size of coal, ore, sand, or other material to be treated.

The rear portion of the box has an upper hinged door, B, which is provided with suitable latches, and there is also a detachable door, C, secured by hooks and staples or other convenient fastenings. The apparatus is mounted upon trucks, so as to render it readily transported from point to point in the yard.

As the material is thrown against the screen, the fine stuff falls through and into the bottom of the box. When a quantity has accumulated, the upper door, B, is opened, and a rake is introduced to draw the screenings to the rear of the receptacle. As soon as the latter is full, the device is wheeled away to the dumping spot, the lower door also removed, and the contents withdrawn.

This simple arrangement prevents the laborious carrying of heavy screens about a yard, and, besides, preserves the yard free from unsightly heaps of dust and refuse to collect. Since there is no possibility of anything passing through the screen, except small fragments, the waste of good coal—which often happens through pieces from the screened heap becoming mixed with the sifted stuff, and requiring too great a loss of time to pick out separately—is avoided.

The doors may be arranged at the side, or a trap may be provided at the bottom, as most convenient.

Patented through the Scientific American Patent Agency, by Mr. Henry L. Leach, of foot of E. 36th street (E. R.), New York city, who may be addressed for further information.

LEACH'S COAL SCREEN.

Consumption of Wood by Railroads.

At the end of 1873, there were reported 71,564·9 miles of main lines, and 13,512 miles of sidings and double tracks, making 85,077·9 miles of railroads within the United States. Of the main lines, 5,462·3 miles were in the New England States, 14,209 in the Middle States, 33,905·9 in the Western States, and 2,681·3 in the Pacific States. Upon these roads locomotives were running, and a large proportion of them used wood for their fuel. The number of ties used varies from 2,200 to 2,800 per mile. If we take 2,500 as a mean, we find that 212,692,500 pieces of timber, eight feet long and from six to eight inches between upper and lower surfaces, are required to supply this single item.

The durability of ties varies with the kind of timber, soil, climate, and use, ranging from four to ten years. Taking six as an average, the amount required for annual supply must be 35,448,750 pieces, or 94,530,000 cubic feet. In considering this, we must remember that a large amount of waste occurs from hewing, and from leaving the upper parts of trees, some of which are used as firewood, the remainder being a total loss. It must also be borne in mind that the demand for timber by railroads, besides for ties and for fuel, is very great, including fencing, bridges, buildings, and structures of various kinds; that the risk from fires is exceptionally great, and that our requirements in this direction are increasing even more rapidly than our supplies are wasting.—*National Car Builder.*

A New Plaster Bandage.

A surgeon connected with the Southern Dispensary, in Brooklyn, N. Y., has recently invented a new method of applying the plaster splint, which, according to the *Tribune*, promises to be an important improvement. A common merino sock is drawn upon the foot and leg. It may extend as far up as is necessary to include the fractured locality. A small rope is run down the back seam in the center of the leg, around the heel and over the toes, returning up the middle of the instep and front of the leg. Six or seven pieces of flannel are then cut out to fit the leg and foot, allowing for shrinkage. The ends of the bones having been carefully adjusted, the stocking, upon which the rope has been attached as described, is drawn upon the foot and leg. The flannels are soaked in warm water and applied, the plaster of Paris paste being rubbed in with layer after layer. After the last layer has been applied, the plaster is allowed to set. When the plaster has become hard, the splint is perfect, and the patient can get about, on crutches, very comfortably. If the leg swells, and it is necessary to remove the bandage, the whole thing can be done inside of three minutes. The cord that has been run around the stocking now forms a line of division in the splint. To remove the splint, all that has to be done is to slip out the cord and slit up the stocking along the line where the cord was. Then the splint, divided in halves, can be removed as though it had been laid upon the limb to obtain a cast. Considerable time is thus gained by using this method of applying the plaster splint. When the broken limb becomes inflamed, it also is extremely painful and very tender to the touch. The slightest jar sends a thrill of pain through the body of the patient, who has sometimes been obliged to be chloroformed to enable the surgeon to remove a plaster splint applied with a bandage. By the new method, the limb need hardly be moved or touched.

Natural Gas for Fuel.

Messrs. Rogers & Burchfield, the makers of a well known brand of sheet iron, at Leechburg, Pa., produce weekly about 70 tuns of such iron; to make this amount 9,100 bushels of coal, or 140 bushels per tun, would be required if they used coal for fuel. They have now been using gas for seven months, procuring it from an abandoned oil well, 1,250 feet deep, situated about 1,000 feet from the works, and from which the gas is conveyed by a three inch pipe. The branch pipes leading to each furnace are half an inch in diameter. They have one battery of four boilers, driving an engine of six foot stroke, thirty inches in diameter, at the rate of forty-five strokes per minute, which furnishes power for six pairs of sheet rolls and one bar train, steam being taken from the same boilers to drive two hammers; another boiler furnishes steam for a blowing cylinder, which supplies the blast for seven knobbling fires and one refinery; another boiler furnishes steam for a small engine driving the rolls for the manufacture of tin plate. This is all done by gas, which is also applied directly in five puddling furnaces, in which the waste is three or four per cent less than with coal, and the quality of the iron is greatly improved; they also furnish gas for four sheet furnaces, and find it much superior to coal, the waste in these furnaces being about five per cent less than with coal; and further advantages gained are softer iron and a finer surface to the sheet. They have three large annealing furnaces, where they anneal in airtight boxes, putting about ten tuns in each box, requiring about ten hours to complete the process of annealing, at a saving of about one half in annealing boxes; and in the tinning establishment the pots of tin, into which the sheets of iron are dipped, are also heated by gas.

To use gas there is no change required in the construction of puddling furnaces, except that they use the patent water necks. These necks are an absolute necessity in using gas for fuel, as without them the intense heat, generated by the

gas, destroys the lining of the stack and melts off the dampers as fast as they can be replaced. The grate bars, the manufacturers state, never burn out, and the puddler's tools last about three times as long as they did when coal was used. In furnaces where the water necks cannot be used, they are compelled to use a jet of steam to lessen the heat.

Their production has increased about thirty-three per cent since they began to use gas, and the iron made commands from $10 to $20 per ton more than the same class of iron manufactured at the Apollo works, where they use coal, the iron being made from the same class of stock. These facts were communicated to the American Iron and Steel Association.

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GAIN FROM THE USE OF FEED WATER HEATERS.

In an ordinary boiler, one pound of average coal will produce by its combustion between eight and nine thousand units of heat that are available for generating steam. Supposing the feed water to enter the boiler at a temperature of 32° Fah., each pound of water will require about 1,200 units of heat to convert it into steam, so that the boiler will evaporate between $6\frac{2}{3}$ and $7\frac{1}{2}$ pounds of water per pound of coal. Better results than these are often realized, especially in the case of tests, but the figures given above are believed to correspond with those of ordinary practice. The amount of heat required to convert a pound of water into steam varies with the pressure, as will be seen by the following table:

Units of heat required to convert one pound of water, at the temperature of 32° Fah., into steam at different pressures:

Pressure of steam in pounds per sq. inch, by gage.	Units of heat.	Pressure of steam in pounds per sq. inch, by gage.	Units of heat.
1	1,148	10	1,155
20	1,161	30	1,165
40	1,169	50	1,173
60	1,176	70	1,178
80	1,181	90	1,183
100	1,185	110	1,187
120	1,189	130	1,190
140	1,192	150	1,193
160	1,195	170	1,196
180	1,198	190	1,199
200	1,200		

If the feed water has any other temperature, the heat necessary to convert it into steam can easily be computed. Suppose, for instance, that its temperature is 65°, and that it is to be converted into steam having a pressure of 80 pounds per square inch. The difference between 65 and 32 is 33; and subtracting this from 1,181 (the number of units of heat required for feed water having a temperature of 32°), the remainder, or 1,148, is the number of units for feed water with the given temperature.

In the use of an ordinary non-condensing engine, in which the steam is exhausted directly into the atmosphere, each pound of steam, as it escapes, carries off the greater part of the heat that it has received in the boiler. This can be rendered plain by an example: Suppose the feed water enters the boiler at a temperature of 70°, that the pressure of steam is 90 pounds per square inch, and that the back pressure in the cylinder, under which the steam is exhausted, is 1 pound per square inch:

Temperature of feed water	70
Subtract	32
Difference	38
Units of heat required to convert 1 pound of water at 32° into steam at 90 pounds pressure	1,183
Subtract	38
Units of heat required to convert 1 pound of water at 70° into steam of 90 pounds pressure	1,145
Units of heat in 1 pound of steam at 1 pound pressure, from water at 32°	1,148
Subtract	38
Units of heat imparted to feed water, that are carried off by each pound of exhaust steam	1,110
Multiply this by 100	111.000
Divide by 1,145	96 941

which is the percentage of the heat, imparted to the feed water, that is carried off by the exhaust steam.

There remains, then, only about 3 per cent of the heat, imparted to the water by the combustion of the coal, that is utilized in the engine. This is a rather serious consideration for the steam user, who may figure up his account with the boiler and engine somewhat after this manner: One tun of coal costs $6.50, and evaporates, by its combustion, 15,000 pounds of water, at a cost for fuel of $0.00043+ per pound. When the steam resulting from the evaporation of this water is used in the engine, 96·94 per cent of the heat imparted to it by the fuel is exhausted into the air. This is the same as throwing away 14,541 pounds of the water that has been evaporated, leaving 459 pounds for useful work, so that really each pound of water used in the engine costs $0 014+. There are very many engines running today to which this account will apply, engines that are sending into the air nearly all the heat imparted to the water by the fuel. We showed, in a preceding article, how considerable saving would generally result by attaching condensing apparatus to a non-condensing engine. This cannot always be done, however; but there are means by which some of the heat carried off by the exhaust can be utilized. The most obvious method is to turn the exhaust steam into vessels through which the feed water passes, so that some of its heat may be imparted to the water, which will then require the consumption of less fuel for its conversion into steam. There are a number of heaters in the market which are guaranteed by their manufacturers to deliver the feed water into a boiler at the temperature of 212°, and we can state from our own experience that this is not an uncommon result, while a temperature of at least 200° should be realized from the use of any good heater. It may be profitable to consider the effect of attaching such a heater in the case previously cited. The feed water will then enter the heater at a temperature of 70°, and be delivered into the boiler at a temperature of 200°, having had its temperature increased 130° by the exhaust steam, which has lost a corresponding amount of heat. Each pound of water will require 1,015 units of heat for its conversion into steam of 90 pounds pressure, instead of 1,145 units, which were needed when the heater was not in use. This gives a gain of 130 units of heat for each pound of water evaporated, being 11 35+ per cent less heat than was required when the feed water was pumped into the boiler at a temperature of 70°. Each pound of exhaust steam, also, instead of carrying off 1,110 units of heat into the air, will only take 980, or 11·71+ per cent less than it formerly did. The account previously given will now figure up as follows:

The combustion of one tun of coal will evaporate about 16,900 pounds of water, at a cost of $0 00038+ per pound. In the engine, an amount of heat corresponding to about 16,300 pounds of the steam is thrown away in the exhaust, leaving 600 pounds for useful effect, at a cost of $0.0108+ per pound.

These examples, which correspond well with cases in ordinary practice, will enable our readers to estimate with tolerable accuracy the results that will be realized from attaching a heater in any given instance. It will be observed that, in the case supposed, no allowance was made for increased back pressure by the use of the heater. This was because the hypothetical heater was properly designed. A good heater does not increase the back pressure in the piston. There are many forms of the apparatus, however, that offer so much resistance to the escape of the exhaust steam, as to more than neutralize the gain that would otherwise be derived from their use. It is easy to see, for instance, that if the introduction of a heater increased the heat of the feed water 10 per cent, but also increased the back pressure so as to call for the expenditure of 12 per cent more fuel, the arrangement would be anything but economical.

A SPECIAL EDITION OF THE SCIENTIFIC AMERICAN.—ONE HUNDRED THOUSAND COPIES.

We shall, during the coming month of December, issue a special edition of the SCIENTIFIC AMERICAN, aggregating one hundred thousand copies, which will be gratuitously circulated among manufacturers of all kinds, machinists, mill owners, and, in brief, representatives of all industries in the United States and in Canada. At considerable outlay of time and expense, we have procured a list of one hundred thousand names, embracing the leading business men of the above important classes; and to each individual a copy of the SCIENTIFIC AMERICAN, enclosed in a separate wrapper and prepaid, will be mailed. The item of postage alone will thus cost the large sum of two thousand dollars, and the issue will find its way into every post office in the country.

Our motive for printing this extra edition, at an outlay of some six thousand dollars, we do not desire to conceal, nor could we do so even if such were our wish. Our aim is to increase our subscription list; and in pursuance of this object, we take such means as will enable others beside ourselves to derive benefit from the enterprise, in direct proportion to the amounts they invest in its furtherance. To this end, therefore, we propose to admit a few advertisements. It will readily be apprehended that, since the publishers are distinctly pledged to print the large special edition above noted, and to mail the same (prepaid) to names selected with care and judgment, every person having goods, productions, or ideas to bring to the notice of the class above mentioned is here furnished with the means. Moreover, it should be remembered that the names to which we refer are not those of our regular subscribers, but of business men not accessible through the ordinary newspaper channels.

We would direct especial attention to the fact that, although a circulation of 100,000 copies is guaranteed, there is every probability that this will be greatly exceeded. Our offer of last year included a circulation of but 60.000; but before we had supplied the demand, 120,000 copies were printed and mailed. For this immense excess, we imposed no extra charge upon our advertisers. The same course will be adopted this year. The extra benefit is given freely to those firms who send us advertisements for the special edition.

To the enterprising manufacturers and inventors who advertise in our regular columns, and indeed to everybody at all conversant with the advantages of a good medium, we need not point out the benefits to be derived from our proposition. For further particulars, see advertisement on another page.

COST OF TUNNELS.

"Among the various plans for disposing of the Jones' Falls stream or improving its channel, which have been presented to the council committee, is one by J. E. Sudler, civil engineer, proposing to divert it by a tunnel from a point beyond the city across to the valley of Gwynn's Falls, and thus throw its waters into the middle branch of the Patapsco, or Spring Gardens. This tunnel would pass in good part under Druid Hill Park, and through a rock formation which, it is believed, lies beneath all the hills in that quarter. Never having looked to diversion in that direction, and without pretending to have examined into or formed any judgment in the premises (the plan lately suggested by the mayor in his special message to the council for improvement within the city being still pending), it may yet be worth while to inquire into what has been the cost of like tunneling, accomplished in other parts of the world. The aggregate cost of this tunnel for Jones' Falls, the length of which is 16,000 feet, is put by its author at $2,300,000, or $145 per lineal foot, which is a fraction over $2 per cubic yard. With regard to other tunnels already in existence, their cost is given as follows: The great Mont Cenis tunnel cost about $300 per lineal foot, including equipment of road, etc. The Kilsby double track railroad tunnel (England), in the construction of which very great difficulties were encountered from the tapping of quicksands, cost $262.50 per lineal foot. Bletchingly tunnel, for a double track railroad in England, cost $120. Terre Noire, on the Paris, Lyons, and Mediterranean railroad, cost but $50 per foot; and the very difficult Hauenstein tunnel, between Basle and Berne, Switzerland, cost $133 per lineal foot. The Hoosac tunnel, through a formation of mica slate and quartz, with working shaft upwards of 1,000 feet in depth, cost $300 per lineal foot.

These tunnels were all completed several years ago, and the cost per cubic yard of material excavated varies from $1 50 to $14. The difficulties met with in their execution have led to the invention of improved apparatus, by the use of which the cost of boring, drilling, etc., is reduced from 100 to 300 per cent. The diamond boring machine was thoroughly tested by Captain Beaumont, R. E., in Lancashire and Cumberland. At Stoughton, the borer reached a depth of 689 feet in two months, that could not have been got at in less than two years by hand labor. In the Clifton tunnel, Bristol Port and Channel Dock Railroad, in hard mountain limestone, the drills advanced at the rate of two inches per minute—outside diameter of boring, two inches. The machine advanced at about five times the speed that could be attained by as many men as could find room to work at a heading. The motor is compressed air. Dynamite is used for blasting, and found to answer admirably. With the aid of these machines the work of tunneling through the hardest rock presents no difficulties of any extraordinary character, and may be executed at a cost very little, if any, greater than the excavation of the same material in open cutting."—*Baltimore Sun.*

To the above, may be added the cost of that portion of the Underground Railway, in New York city, now nearly completed, on Fourth Avenue, between 44th street and Harlem

river at 133d street, a distance of about 4½ miles. This railway has four tracks, and consists chiefly of open cuts and tunnels, but includes a massive stone viaduct 60 feet wide, 30 feet high at greatest elevation, and about 6,500 feet long. The open cuts are about 66 feet wide, walls included, and from 10 feet to 14 feet deep, spanned at the street crossings by splendid iron bridges. The tunnels are of three kinds, brick arches, flat iron beam tunnels, and rock tunnels. They consist of three parallel tunnels, one central and two separate side tunnels, all occupying a space under the streets of about 70 feet in width by 30 feet in depth. At about every half mile are roomy passenger stations and waiting rooms, also constructed underground, lighted from the sidewalks. Altogether this is one of the finest examples of underground railway construction in the world. It has been in progress for the past two years, and will be finished in January next. The total contract price of this great work, including stations, bridges, ballasting, viaduct, tunnels, changes of water pipes and sewers, is $6 395,070, being at the rate of a little under $385 per lineal foot. Considering the large size, this is a very moderate cost; and for once the city of New York, which pays one half of the bill, has not been cheated or imposed upon.

We recently made a personal inspection of the work from beginning to end, carefully examined all the details of construction, and were much gratified to observe the extreme care taken to render every portion solid and enduring. We shall in our next commence a detailed account of the entire line, drawings for which have been kindly supplied to us by the officer in charge. These papers will be read with interest by civil engineers in all parts of the world, as they involve many practical examples of the most recent construction, executed under the supervision of individuals of eminence in the profession.

EXPLOSIVE WOUNDS FROM NON-EXPLOSIVE BULLETS.

The use of explosive bullets in war is forbidden by international agreement. During the Franco German war, the French were repeatedly accused of violating this humane compact; and the charge, though indignantly denied, seemed to be justified by the nature of the wounds which the German surgeons had to deal with. Where the ball entered, a small round aperture would be observed, while its course within the body would frequently be marked by a fearful shattering of bones, and its aperture of exit would show a ragged opening that one could thrust his fist in. Only by the explosion of the ball on striking the bone, it was thought, could such mutilation be possible. The accused have now the full though tardy satisfaction of having their innocence thoroughly established by German investigations.

In a paper read last year before the German Surgical Congress, Professor W. Busch, of Bonn, called attention to the fact that wounds such as had been attributed to explosive bullets were made by the Chassepôt bullet fired at short range. He explained the phenomenon by supposing that the ball became melted and broken up by forcible contact with the bone, and acted like a mass of shot on the parts beyond. That the ball would be heated by the sudden arrest of its motion, full or partial, could not be doubted; and the spreading of the ball in star shape when fired against an iron target was urged as proof that the heating may be sufficient to melt the lead.

Dr. Augustus Küster was not satisfied with this explanation, and has since been conducting experiments on gunshot wounds in animals at the Royal Military School at Spandau, the results of which have been published in a late number of the *Berliner Klinische Wochenschrift*. In making the experiments, a large target was placed behind the animals (horses and wethers), so that the condition of the bullets could be observed after their passage through the bodies. The distances were five, twenty, one hundred, and eight hundred paces. The arms used were a muzzle-loading sporting rifle throwing a pointed bullet, the needle gun, and the Chassepôt, Mauser, and Henry-Martini rifles. The animals were first killed by a volley from all the weapons, and subsequently the carcases were used for further experiments. Omitting details of interest only to surgeons, the results of the investigation may be summed up as follows:

1. There is no essential difference in the action of bullets on the living and on the dead body. Heretofore the opinion has been that gunshot wounds are more extensive in the living than in the dead body, and that by the wound it can be told whether the injury was done before or after death—a position no longer tenable. Owing to the greater toughness of the skin of animals, the aperture of exit is not so large as in the human body; the destruction of the flesh and bones, however, is equally extensive.

2. The extent of the destruction is in inverse ratio to the distance, and in direct ratio with the initial velocity of the bullet. The sporting rifle made the simplest wounds. Then followed the needle gun, the Chassepôt, and the Mauser rifle, which produced frightful destruction of the bones and soft parts.

3. The destruction of the tissue is produced by the lead becoming heated and broken up, but without being melted. The bullet is mechanically divided, leaving the finer particles of lead in the recesses of the wound, while the fragments of larger size pass out along with pieces of shattered bone, flesh, etc. Most of the Chassepôt and Mauser bullets, which have the greatest initial velocity, passed through the animals' bodies reduced by one half or more, and greatly altered in shape, making on the target an irregular impression, surrounded by a crown of small pieces of lead, carrying fragments of bone, muscle, hair, etc. The wounds made at short range were frightful.

4. The injuries described are made only by bullets of soft lead. The Henry-Martini rifle stands alone in using a ball of hard lead, or lead mixed with tin in the proportion of twelve parts to one. The initial velocity of the ball thrown by this rifle is almost as great as that of the Mauser, yet the wound produced by it is very much smaller. It makes a clean hole through flesh and bone neither shattering the bone nor leaving splinters of lead in the course of the wound. In one case only did Dr. Küster find a Henry-Martini bullet much misshapen, and that time it remained sticking in a bone. On but one occasion, when fired at a hundred paces, did it fail to pass through the longest diameter of a horse, while the Mauser bullets frequently remained in the wounds, owing to the greater resistance they had to overcome in consequence of their greater misshapement.

Having shown that bullets of soft lead fired at short range act just like explosive bullets, and that a close combat with them can be nothing but a horrible butchery, Dr. Küster protests against their use; and as a duty to a brave opponent, he takes pains to say that the French stand thoroughly acquitted of the charge of having committed an act of unworthy and interdicted barbarity.

WHAT TEMPERATURE KILLS?

At the present stage of enquiry, the very important biological question whether life does or does not ever appear otherwise than as a product of antecedent life plainly hinges on the simpler question: What temperature kills? In other words, what degree of heat is certainly fatal to living matter? A boiled egg will not hatch, boiled seeds will not germinate; no animal or plant thus far experimented on has been found to survive exposure to boiling water. Yet the appearance of living forms within hermetically sealed flasks, the contents of which have been boiled ten minutes or more, has been observed by too many trustworthy witnesses to be longer doubted. The question to be settled is: Are there any forms of living matter, germs, seeds, or what not, that can endure 212° of temperature by Fahrenheit's scale? And if so, what higher temperature certainly kills them?

The first to attack the problem with scientific thoroughness and care was the acute and learned Abbé Spallanzani, something over a hundred years ago. At that time Needham was advocating the doctrine of spontaneous generation, on the strength of experiments similar to those which later investigations have made familiar. Spallanzani repeated the experiments, and found that the lower infusoria certainly would appear within closed vessels previously subjected to boiling heat. The organisms themselves were killed by a temperature of 108¼° Fah. Unwilling to accept the conclusion arrived at by Needham, the Abbé assumed that the unknown germs of the infusoria must be able to withstand the higher temperature, and thereupon set to work to discover whether the difference in the capacity of resisting heat, imagined to exist in this case between parents and germs, could be justified by the establishment of similar differences in heat-resisting capacity between other parent organisms and their germs. By a careful series of experiments, he found that, while frogs and tadpoles perished at 111° Fah., frogs' eggs appeared in some cases to resist the temperature of 131° Fah., none, however, surviving 144¼° or upwards. Aquatic salamanders and fish were likewise killed by water having the temperature of 111°. Silkworms' eggs and the eggs of the elm moth failed to germinate after being heated to 140° Fah. The developed worms died at 108¼°. Leeches perished at 111°; the *nematoids* known as vinegar eels, at 113°; other aquatic worms at 111°, and water fleas at 107°. Thus, while about 110° Fah. sufficed to kill matured forms, their eggs were not killed under about 140° Fah.

Observations on seeds and plants were conducted in a similar manner, the water being heated slowly and the seeds and plants taken out as soon as the desired temperature was attained. Not one seed germinated after exposure to boiling water. Of the corresponding plants a few survived a momentary exposure to 156°, none the temperature of 167°. (The grades of heat experimented with differed for the most part by 5° Réaumur, or 11¼° Fah., so that the thermal death point was not precisely noted.)

From these experiments it was manifest that (1) eggs can endure a higher degree of heat than the animals from which they are derived: (2) a similar difference exists between plants and seeds: (3) seeds and plants resist higher grades of heat than eggs and animals. Not a single living thing, however, egg or seed, animal or plant, survived a brief exposure to a moist heat of 212° Fah.

To the dryness of seeds was evidently due their ability to withstand heat better than eggs. Certain eggs resemble seed in that they may be dried and yet develope after being placed in a suitable damp medium. Might not the germs of the lowest animalcules likewise withstand desiccation, and in a dry state excel seeds in power to bear heat, as the seeds excel eggs? Inasmuch as the germs in question were invisible and unknown, they could not be subjected then to the test of certain experiment; and on the ground of their hypothetical existence and power, Spallanzani was able to refuse assent to the probability of the germless origin of living matter in the cases under consideration.

Unfortunately for the panspermatist position, Spallanzani's assumptions are not merely not sustained but are positively contradicted by more recent investigations. Professor Burden Sanderson shows that, so far from being able to withstand desiccation, the germinal particles of *bacteria* are killed by simple exposure for three days to dry air of the low temperature of 104° Fah., and that the fully formed animalcules are deprived of their power of further development by thorough desiccation. Further, Dr. Charlton Bastian (who reviews this question of the thermal death point of matter very fully in the *Contemporary Review* for September) has shown that all direct experiment, on the power of *bacteria* and their germs to withstand heat, leads to the conclusion that they are both killed by a brief exposure to a moist heat of 140° Fah. Many investigators, working independently of each other, and often without reference to the origin of life question, coincide in showing that, with certain peculiar exceptions, the temperature of 140° Fah., with moisture, is fatal to living matter.

In very many, if not most, cases the death point is much lower. Thus according to the observations of Spallanzani, Max Schultze, and Kühne, simple aquatic organisms die under temperatures ranging from 104° to 113° Fah. According to Kühne, elements of the cold-blooded frog are killed at 104°. Stricker and Kühne agree in fixing the thermal death point of the tissue elements of warm-blooded man at 111°; that of the tissue elements of plants, according to Max Schultze and Kühne, is from 116½° to 118¾°: while Spallanzani, Liebig, Tarnowski, and others find that eggs, fungus, spores, and *bacteria* germs are killed at temperatures between 122° and 140°.

The exceptional cases are the *confervæ* and allied organisms observed by Dr. Hooker in Sorujkund, flourishing in a hot spring of the temperature of 168° Fah.; others in water of 174°, as observed by Captain Strachey in Thibet; in 185°, as observed by Humboldt in La Grinchera; 190°, as observed by Dr. Bremer in California; and 208°, or 4° below the boiling point of water at sea level, as observed by Descloiseaux in Iceland.

"It is a well known physical fact," says the late Professor Wyman, commenting on the examples of life at high temperatures above given, "that living beings may be slowly transferred to new and widely different conditions without injury; but if the same change is suddenly made, they perish. In the experiments made in our laboratories, the change of conditions is relatively violent, and therefore liable to destroy life by its suddenness."

Even if it were possible for living organisms to withstand suddenly the temperature to which these exceptional growths have become inured through long periods of time, the difficulty attending the appearance of living forms, in hermetically sealed flasks which have been previously heated as high as 275° Fah., as recorded in Dr. Bastian's latest experiments, would not appear to be greatly lessened. The evidence is overwhelmingly against the survival of living matter after prolonged boiling, much less after exposure to a temperature sixty degrees higher.

SCIENTIFIC AND PRACTICAL INFORMATION.

WORKING MEN'S HEALTH.

From a report of Dr. Waller Lewis, a noted English physician, regarding the health of French working men, it appears that the percentage of deaths from consumption, in 1,000 cases collated, is for various trades as follows: Exposed to vegetable or mineral emanations, 176; to dust and fine particles, 145; sedentary occupations, 140; employed in close workshops, 138; exposed to hot and dry air, 127; requiring active muscular exercise, 89; requiring exertion of voice, 75; working in open air, 73; exposed to animal emanations, 60; the remainder being made up of persons working in a stooping posture, exposed to sudden movements of the arms, or exposed to watery vapors. Concerning the effect of various employments on the eyesight, it seems that the sense is injured by those working with polished metals, looking glasses, etc. The smallness of objects and intensity of direct or reflected light is also a cause of impaired vision; while astronomers who study the sun have become totally blind, and opticians who daily exercise and test spectacles, etc., engravers, watch makers, etc., are liable to amaurosis and amblyopia.

THE POPULATION OF CHINA.

Abbé David, who has recently devoted some years to the exploration of Chinese territory and the study of the people, says that the estimate of statisticians that the total population of the Chinese Empire is but 100,000,000 souls is entirely incorrect. The error is due to the terrible ravages made in certain small political divisions, which have rebelled at times, and in which wholesale massacres have reduced the inhabitants to one half and in some cases one fifth their former numerical strength. The province of Kiangsi is, however, the least populated, and the average of each canton therein is 4,000 people. There are 4,345 cantons, making an approximate total of 17,380,000 inhabitants. Among the 18 provinces of the Empire, it is certain that several largely exceed Kiangsi in population; but taking the above given aggregate as a unit, there must be at least 300,000,000 individuals in the country.

ACTION OF SULPHURIC ACID ON LEAD.

From recent experiments by H. A. Mallard, it appears that acids below 61° Baumé, concentrate by boiling until they attain a temperature of 433° Fah., or that at which acids at 61° Baumé boil. They then attack lead, producing sulphurous acid and some sulphate of the metal. Acids above 61° Baumé and below 65·5° Baumé concentrate by ebullition up to 780° Fah., the boiling point of acids of the latter density, when they attack lead, producing sulphate of lead, sulphurous acid, and a little sulphur. Acids of 65·5° Baumé at 482° Fah. also attack lead, producing the results last mentioned.

THE EAST RIVER BRIDGE.—It is expected that in four weeks from this date the Brooklyn tower of the East River bridge will be completed. On October 24 a hight of 259 feet had been attained, and there were seven more courses, about 14 feet, of stone to be added. The anchorage on the Brooklyn side is also in a forward state.

PEAS THREE THOUSAND YEARS OLD.

In the course of late explorations in the ancient ruins of Egypt, General Anderson, an English traveler, found, inclosed in a sarcophagus beside a mummy, a few dry peas, which he preserved carefully and, on his return to Great Britain, planted in the rich soil of the Island of Guernsey. The seeds germinated, and soon two little plants appeared, from which, at maturity, sufficient peas were gathered to plant quite a large tract of ground in the following season.

Some of the plants thus raised have attained a hight of over six feet, and have been loaded with blossoms of exquisite odor, and of a delicate rose tint. The peculiar feature of the growth is the stem, which is small near the root but increases greatly in size as it ascends, requiring a support to sustain it upright. The pods, instead of being distributed around all portions of the stem as in the ordinary plant, are grouped (as shown in our engraving, extracted from the London *Graphic*) about the upper extremity.

The vegetable, it is said, belongs to the ordinary garden variety; but from its presenting the very distinctive differences above noted, it seems worthy of close botanical examination. The peas are of remarkably fine flavor, excelling in delicacy those of the choicest known varieties.

PLANT GROWN FROM A MUMMY PEA.

Discoveries by the Wheeler Exploring Expedition.

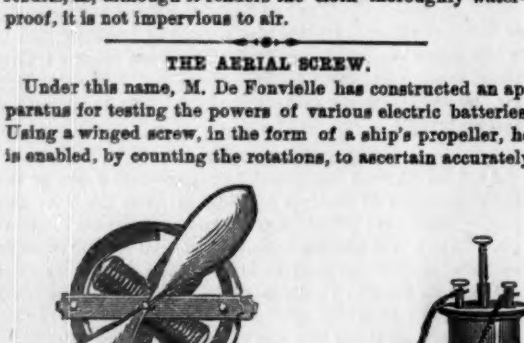
Professor Cope and Dr. Yarrow, of the Wheeler Expedition, have unearthed, in the valleys of the San Juan river, another immense deposit of fossil remains of prehistoric animals. A large number of vertebrates of enormous size, and of genera unknown to Science, have been found, together with others of very rare species, including skeletons of mastodons and mammoths, in a very perfect state of preservation. The fruits of the discovery are not yet classified and arranged, so that a complete list cannot be given; but specimens have been forwarded to Washington, where, we understand, the naturalists have already begun work upon them. The entire collection is said to be a most valuable contribution to palæontology, and will add greatly to our knowledge of that branch of Science. We notice, also, that the investigations as to the living animals of the country explored, are meeting with excellent results. As many as 1,000 birds' skins have been obtained, including several of new varieties of birds. Five new species of fishes, it is said, have also been discovered.

Waterproofing Compound.

This compound is prepared by melting paraffin and adding gradually a suitable drying oil, stirring well to insure intimate mixture; it is then poured into molds the shape of bricks or blocks, and allowed to cool. The fabric to be rendered waterproof is rubbed over with a block of the compound, warming the rubbing face gently if the atmosphere is cold, and then ironing the cloth with a warm iron, or passing it between hot rollers. The application of this compound to leather and textile and felted fabrics is said to give excellent results, as, although it renders the cloth thoroughly waterproof, it is not impervious to air.

THE AERIAL SCREW.

Under this name, M. De Fonvielle has constructed an apparatus for testing the powers of various electric batteries. Using a winged screw, in the form of a ship's propeller, he is enabled, by counting the rotations, to ascertain accurately



the power of any motor which he may apply to it. Our engraving shows clearly the manner of its use. With a screw of 12 inches diameter and a motor of three magnets weighing about 2 lbs. each, a speed of rotation of 5 turns per second was obtained from a battery equivalent to 6 Grove's elements. The speed can be minutely and precisely adjusted by varying the battery power, and experiments on the size and pitch of the blades of propellers can be readily made. The inventor, in *La Nature*, recommends it to Mr. Bowdler's notice, believing that it would be useful to him in his military balloon experiments, of which we gave an illustrated description on page 67 of our current volume.

Apparatus for Breathing Rarefied Air.

M. Bert, whose interesting researches of the effects upon animal life of compressed and of rarefied air we have fully described, suggests a simple device for use by travelers ascending high mountains or by aeronauts. It consists of a Y tube, one arm of which is connected with an oxygen bag made of inelastic material. The other arm is open to the atmosphere; and in a rounded portion inside, near its junction with the balance of the device, is a small balloon of elastic material filled with ordinary air. The mouth is applied to the end of the straight part of the Y. As the elevation of the person using the apparatus increases, the ball in the tube expands, owing to the decreased air pressure, and hence closes the orifice leading to the surrounding atmosphere. The supply for the lungs is therefore drawn in a greater proportion from the oxygen receiver, enabling the functions of respiration to continue without uneasiness.

Non-Corrosive Pipes and Plates.

A recent patent by W. A. Shaw, of New York city, has for its object to protect tubes or metal plates from corrosion by associating with them other metals or alloys, the presence of which renders the entire combination passive. It is known that the presence of platinum protects iron from corrosion, and that zinc will partially protect iron and copper. An instance of the last named fact is the well known application, by Sir Humphrey Davy, in sheathing vessels.

One method of carrying out the present invention is to make a pipe or tube of any one or more of the ductile metals, by drawing, rolling, or by pressing said metals out of a cylinder through a die. At the same time this operation is being performed, a ribbon, band, or wire of a protecting metal or metals is drawn through the die with the tube under treatment, emerging therewith, either wholly or partially inlaid within the inside surface of the tube. One or more such bands may be thus inlaid, and they may be alike, or of different metals. The inlaid bands may be embedded in the shell of the pipe, so as to be flush with the surface thereof, or they may be allowed to project, so as to present a greater amount of protecting surface.

It is alleged by the inventor that, when strips of lead and tin are simultaneously exposed to the action of water, the presence of the tin effectually protects the lead from corrosion, and that there is practically no corrosive action upon these metals when associated in this manner.

Changes of the Sun's Apparent Diameter.

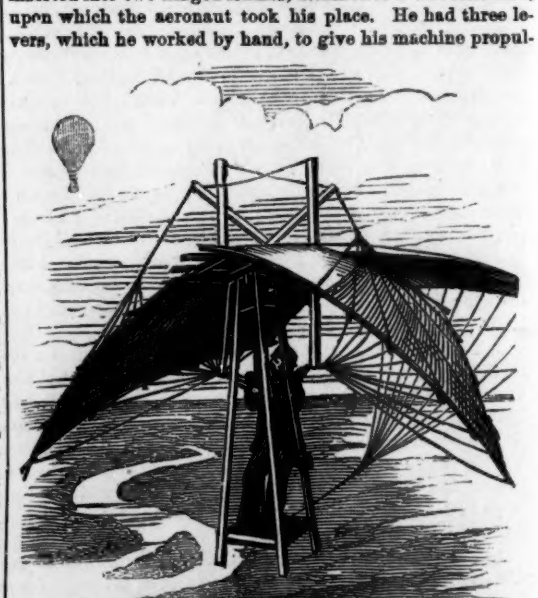
The question of whether the sun's apparent diameter is subject to any changes which can be detected by observation is discussed in the *American Journal of Science and Arts* by Professors Newcomb and Holden. The calculations of these astronomers indicate that during some years (1864 and 1870, for instance) there was a tendency to a ten hour vibration of the solar diameter. The conclusion, however, is that this correspondence cannot be attributed to anything but chance.

New Railway Refrigerating Car.

Trial was made recently on the Great Western Railway, Eng., of a car, the invention of Captain Acklom, for the transport of meat in a purer and colder air than in the ordinary close cars, so as to preserve the freshness of the carcases. The car does not differ much in appearance from an ordinary railway wagon, and the patentee claims that it can be built at little more expense, and filled on occasion with any class of merchandise for which an artificially cooled temperature is not required. The body of the car consists of a double paneling of galvanized iron network, with the space between filled with two couches of inodorous absorbent felt, the outer one four layers thick, and the inner one, an inch apart from it, but a single layer. The mesh of the external panel is much larger than the corresponding mesh inside, in order to permit free ingress to the heat and atmosphere. The inner panel alone forms a ceiling to the chamber, and is covered with the felt, but with an interval of a couple of inches between its surface and the arched outer roof. The object of this arrangement is to admit the passage of a current of air when the car is in motion. Underneath is a tank from which water is driven by a forcing pump to a covered galvanized iron gutter, running round the edge of the roof, between the panels; the outer felt is lipped in this gutter, so that the water is bound to percolate through it to a metal-lined groove below, which returns the drip to the tank. The atmosphere coming in contact with the saturated felt causes evaporation, and lowers the temperature within, while the single inner layer of dry felt preserves the meat from moisture; and it is a curious fact, the warmer the weather is, the quicker the evaporation, and consequently the cooler the interior. The carcases are strung up on a row of double hooks inside, as in a butcher's stall, and it is stated that one car can carry those of 17½ bullocks, or eight tuns of meat. The trial may be pronounced satisfactory, although the car is still susceptible of improvements, the thermometer suspended within it having registered only 62° Fah., while that of the outer atmosphere was ten degrees higher. Captain Acklom undertakes to supply provisions sound and sweet to the salesman, even in the heat of the dog days, and to carry fish and newly killed meat two or three days, if necessary, untainted. Poultry, milk, vegetables, and fruit can also be transported, in all their freshness, in this felt convenience.

M. DE GROOF'S PARACHUTE.

On page 99 of our current volume, we mentioned the death of Vincent De Groof, who was thrown, from a flying parachute of his own construction, from a hight of 80 feet to the ground and instantly killed. We now publish an engraving of the invention, which was, in general plan, an imitation of a bat's wings, the framework being made of cane, and the intervening membrane of stout waterproof silk. "The wings were altogether 37 feet long, with an average breadth of 4 feet. The tail was 18 feet by 3 feet. These wings were inserted into two hinged frames, attached to a wooden stand, upon which the aeronaut took his place. He had three levers, which he worked by hand, to give his machine propul-



sion or guidance, as might be required. His theory was that, having started from a given hight, he could manage his descent so as to reach the earth by a sort of inclined swooping motion, without risk of concussion."—*Illustrated London News.*

The result to the constructor is given above.

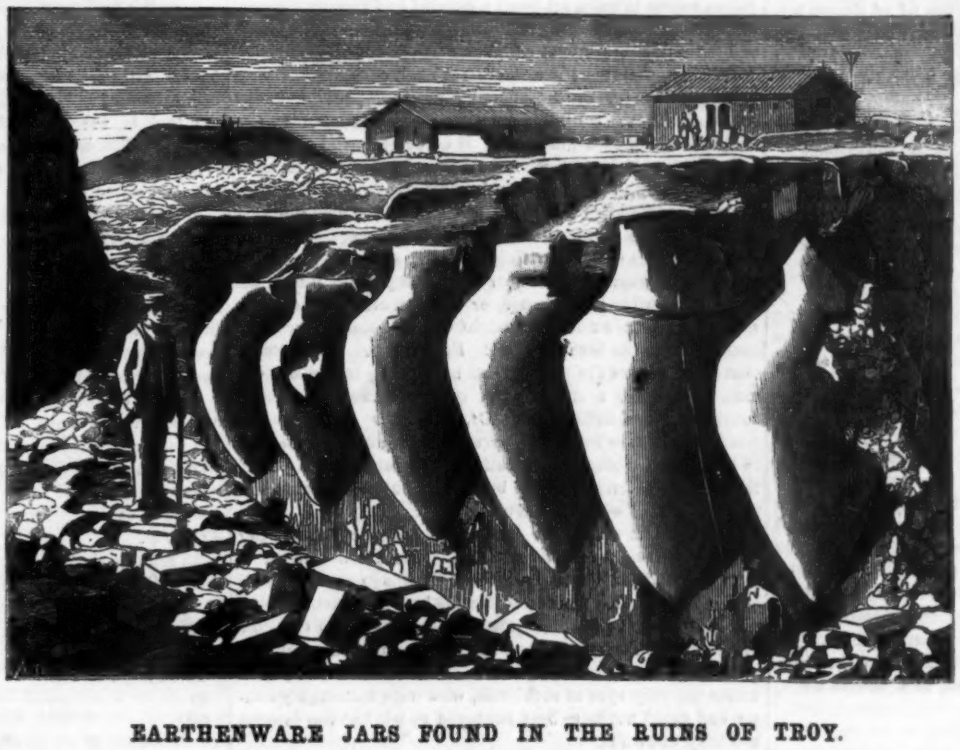
THE Metropolitan Railway of Constantinople is nearly completed. The brickwork of the tunnel, from Pera to Galatz, has been finished, and the rails are now being laid.

THE RUINS OF TROY.

The researches of Dr. Schliemann, on the supposed site of the city of ancient Troy, have recently been rewarded by discoveries which have a worldwide interest, proving not only the existence of the city, so often and so strenuously asserted to be purely mythical, but the general accuracy both of the Homeric and Virgilian, the Greek and Latin, accounts of the people, their celebrated citadel, and its ten years' siege. These revelations prove incontrovertibly that the site of the city, supposed by Herodotus, Xenophon, Plutarch, and many other writers to be on the hights now called Hissarlik, was accurately laid down by those writers.

Indications of a destruction by fire, terrible enough to have justified Virgil's tremendous description, have also been found; and the Trojan goddess (Minerva) is exhibited, in the form of her favorite owl, on vases and earthenware utensils, on metal implements and trophies, and in every possible form.

Several large earthen jars, of peculiar shape, were discovered by Dr. Schliemann; and we publish an engraving of them *in situ*, for which we are indebted to *La Nature*.



EARTHENWARE JARS FOUND IN THE RUINS OF TROY.

New Steamer.

A new and economical steamer, named the Ferdinand Vandertaelen, has lately been built and tried at South Shields, England. Her length is 273 feet; breadth, 34 feet, and depth, 24 feet 6 inches. The diameters of the cylinders are: high pressure 32 inches, and low pressure 60 inches, 3 feet stroke, working pressure, 70 lbs. per square inch; the maximum power developed was 395 in the high pressure and 408 in the low pressure engines, making a total of 803 indicated horse power. The coal burnt during the test was at the rate of 880 lbs. per hour, or 1·54 lbs. per indicated horse power per hour. The speed of the ship, ascertained by the patent log, was 11 knots per hour.

Predicted Failure of the Bessemer Swinging Saloon.

Our own experience at sea in all sorts of weather and in all kinds of boats—from a fisherman's coble in a chopping sea to the Irish mail boats in a gale—leads us to hold as a matter of faith that rolling does not cause sea sickness in even the most delicate organization, and that pitching does. The original Bessemer saloon provided for pitching as well as rolling, but the saloon as fitted on board the Bessemer can move athwart ship only, and consequently deals only with rolling. Mr. Bessemer has, in a word, abandoned the idea of contending with the true cause of sea sickness, and confined his attention to combating what is a very secondary evil indeed, if it can be called an evil in any sense as regards the causation of sea sickness. This being the case, a passenger on the deck abreast the saloon will be just as likely to escape the horrors of a Channel passage as if he were in the saloon, except in so far as the rolling of a vessel of such great width may in a measure approximate, in its effects on any one standing near the bulwarks, to the pitching motion of a shorter ship. The reason why pitching causes discomfort is, physicians tell us, because the contents of the abdomen rise by their own inertia, to speak a little incorrectly, against the descending diaphragm. The motion of a pitching ship in a gale is very considerable. Thus it has been shown that the taffrail of an American liner often falls through a vertical space of 30 feet in about one second when running in a heavy sea. The effect of such a drop as this is, beyond all comparison, more severe than anything rolling produces. We do not think that Mr. Bessemer was unwise to abandon that portion of his original scheme which dealt with pitching. It is very difficult, indeed, to see how, on the one hand, he could have retained it and a reasonably light draft of water together, and, on the other, of what possible utility it would be in his ship. The swinging cabin is already amidships, and will therefore have the least possible motion; and what remains, consisting as it does of the bodily rise and fall of the ship as she mounts a wave or it passes from beneath her, could not be affected by any mechanical expedient placed at mid length. To be really useful, the swinging saloon should be nearly as long as the ship, and at the same time narrow; and it should be so balanced, like a scale beam, and so geared that, however much the bows and stern of the hull rose and fell, the swinging deck would remain approximately horizontal. Thus, suppose that such a saloon was fitted to an Atlantic mail steamer, then a passenger berthed aft, instead of rising and falling through a range of 20 feet or so, perhaps six or eight times a minute with varying velocities, would always remain practically at rest, the ship alone rising and falling. Again, if it were possible, a small saloon near the bow might be mounted, say, on a hydraulic ram, and caused to apparently rise and fall, but really to remain motionless, while the ship pitched. In a saloon fitted in this way we believe that perfect immunity from sea sickness, or nearly so, might be secured. But Mr. Bessemer has done nothing of the kind, and his swinging cabin will be correspondingly inefficient. Whatever comfort the passengers within it may enjoy will be due not to the action of the cabin, but to its position in the mid length of the ship, where vertical motion is reduced to a minimum.—*The Engineer.*

Preserving Gum Arabic Mucilage.

A writer in the *Journal of Pharmacy* states that the instability of mucilage of gum arabic may be overcome by mixing with tolu water. Tolu water is prepared by rubbing two fluid drams saturated tincture of tolu with four drams carbonate of magnesia, and then adding two pints of water, and filtering. It is believed that tolu prevents changes in liquids upon the same principle and as effectually as benzoin obviates rancidity in unctuous substances. Its preservative influence might be utilized in the preparation of many sirups and mixtures which are remarkable for instability.

UNIVERSAL ANGLE BRICKS.

In order to build oblique angles in constructing brick walls, the usual plan is to have bricks specially made for the purpose (if the work be carried on during the brickmaking season), or else to have the ordinary shaped bricks ground to the required form. That this entails trouble, delay, and expense, masons and architects are generally well aware; and hence no further reasons are needed for directing attention to a recent invention, which is designed to obviate the difficulties mentioned.

Fig. 1

Fig. 2

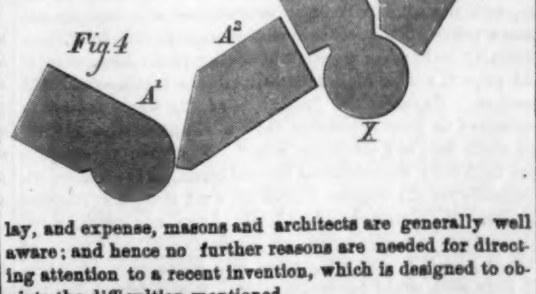
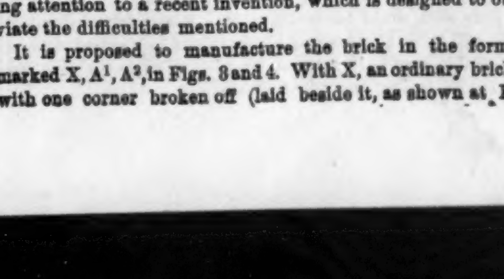


Fig. 3

Fig. 4



It is proposed to manufacture the brick in the forms marked X, A^1, A^2, in Figs. 3 and 4. With X, an ordinary brick, with one corner broken off (laid beside it, as shown at E, Fig. 3) forms an acute angle. Referring to Fig. 1, the same shape, X, is combined with whole bricks to make an obtuse angle. It should also be noticed that the method of laying the bricks results in forming a perfect bond; thus, in Fig. 1, the second brick, X, from the top, instead of having its square portion directly under the corresponding part of the brick of like shape immediately above, has it on the opposite wing of the angle, at D. The fourth brick also has its square end on the same side, and the intervening space is filled with a common brick, E. In Fig. 4, both bricks are of particular form. A^2 has one end formed to certain angles, and A^1 is somewhat similar to X, though having certain easily detected points of difference.

In Fig. 2 a combination of forms A^1, A^2, C^1, and C^2 is shown, the mode of making the bond being as already described. Thus bricks of forms C^1 and C^2 are uppermost then forms A^1 and A^2 succeed, and so on alternately.

In Fig. 1 the result is a neat angle, ornamented beside with a beading; while in Fig. 2 the bead is rendered more ornate by alternating the forms A^1 and C^1. A handsome finish is thus given to the junction of the walls.

These bricks are, of course, susceptible of a variety of modifications in form, adapted to different classes of structures. It will readily be seen, however, that the principle is such as to enable any desired angle to be built without changing the figures of the bricks as produced by the manufacturers.

The inventor is Joseph E. Billings, of 33 School street, Boston, Mass., to whom all communications with reference to obtaining rights to manufacture, or for further information with regard to the uses and capabilities of the bricks, may be addressed. Patented September 1, 1874.

We understand that arrangements are now in progress for manufacturing in New York, Boston, and Philadelphia.

Mind Reading.

The professors of Yale College, New Haven, Conn., have lately been entertained by the performances of J. R. Brown, the mind reader. The learned professors indulged in hiding coins, pencils, cards, etc., in books, corners, and drawers. Brown was then placed *en rapport* with the hider, that is, he took the hand of the person who hid the article, or took hold of a line held by that person. Brown, although blindfolded, would lead the individual to the exact spot, and find the article. Professor Thacher purposely imagined a pain located under his nose. Brown immediately placed his finger in the precise spot. Professor Marsh imagined a particular word, wrote it on paper, and gave it to another person. Brown spelled it out at once by pointing to the respective letters in an alphabet written on a blackboard. The venerable Ex-President Woolsey concealed a coin under some books, but his mind was probably hazy, for Brown could not quite find it, though he came near the spot. But when put *en rapport* with a younger man, Professor Whitney, Brown immediately found the coin. Professor Brewer placed a tape measure in a distant apartment; Brown promptly went, blindfolded, to the place and found the article. Professor Fisher gave a pencil case to Professor Johnson, who gave it to Professor Thacher, who concealed the article. Brown led the latter directly to the spot, and found the pencil. Professor Lyman held a paper on which words were written by Professor Fisher, and, blindfolded, Brown spelled the words without difficulty! Having witnessed so many of these curious experiments, it is to be hoped that the learned professors of Yale will be able to explain how they are done.

Artificial Bone Black.

The only process which allows of producing artificial decolorizing charcoals, approaching, in their properties to bone black, consists in impregnating woody matters with phosphate of lime dissolved in hydrochloric acid. The phosphates are thus distributed as they are in natural bones. The mass thus prepared is ignited. The difficulty consists in obtaining products of a sufficient density and mineral richness, and free from foreign salts. The charcoal obtained has to be washed in excess of water to remove chloride of calcium, if poor coprolites have been employed. The author uses the coprolites found in small granules in the gray phosphatic chalk of Ciply.—*M. Melsens.*

IN our article on the hydraulic ram, page 259 of the current volume, the first part of the description of Fig. 4 should read as follows: The pipe, A, leads to a source of supply higher than the ram, and the pipe, B, connects with the place which is to be drained. The distance from the end of the pipe, B, to the valve, D, must not be greater than the hight to which water will rise in a vacuum.

FROM a late report of our diplomatic representatives in Paris, it appears that the commerce of the United States with that city reaches an aggregate of seventy millions of dollars per year.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for November, 1874.

Mercury.

Mercury rises on the 1st of November at 8h. 37m. A. M., and sets at 5h. 39m. P. M. On the 30th, Mercury rises at 5h. 23m. A. M., and sets at 3h. 33m. P. M. It cannot, therefore, be seen in the early part of the month, and in the latter part should be looked for in the morning.

Venus.

Venus is at its greatest brilliancy on the 2d of November, when it comes to meridian or souths at about half past two in the afternoon. It rises on the 1st at 10h. 22m. A. M., and sets at 6h. 36m. P. M. On the 30th, it rises at 8h. 25m. A. M., and sets at 5h. 7m. P. M.

It should be observed in the early part of the month, and can be seen, a very conspicuous object, in the southwest.

Mars.

Mars is not well situated for observation. It rises on the 1st at 3h. 11m. A. M., and sets at 3h. 21m. P. M., coming to the meridian in the daytime. On the 31st, Mars rises at 2h. 48m. A. M., and sets at 2h. 6m. P. M.

Jupiter.

Jupiter is not well situated for observation; and according to the *American Nautical Almanac*, its satellites cannot be seen before the 5th of November. It rises on the 1st at 4h. 46m. A. M., and sets at 4h. 2m. P. M. On the 30th, Jupiter rises at 3h. 21m. A. M., and sets at 2h. 22m. P. M.

Saturn.

Although Saturn is very far south in declination, it is well situated for observation, and will richly repay any one who looks at it, with the aid only of a small telescope. The ring is so situated that the base can be seen both above and below its plane, and on fine evenings the division of the ring can be traced. A telescope whose object glass is two or three inches in diameter will show the ring, and possibly the largest satellite, Titan. With a large telescope, the other satellites are seen as very minute points of light.

Saturn rises on the 1st at 1h. 10m. P. M., and sets at 10h. 46m. P. M. On the 30th, Saturn rises at 39m. before noon, and sets at 9 o'clock P. M.

Uranus.

Uranus rises at 11h. 22m. P. M., and sets at 1h. 28m. P. M. of the next day. On the 30th, Uranus rises at 9h. 28m. P. M., and sets a little before noon the next day. As it is in northern declination about 17°, it attains a good hight, and can be seen on the meridian in the early morning.

Neptune.

Neptune cannot be seen without a good telescope. On 1st, it rises at 4h. 32m. P. M., and sets at 5h. 40m. A.M. On the 30th, it rises at 2h. 36m. P. M., and sets at 3h. 42m. next morning.

Sun Spots.

The record is from October 2 to October 19 inclusive; but owing to cloudy days, photographs have been taken only on the 2d, 3d, 5th, 9th, 12th, 16th, 17th, and 19th. On the 2d a group of spots, comprising three of good size and several smaller, was seen within the eastern limb and below the center. Pictures of the 3d and 5th showed the same group moving across the disk with the revolution of the sun on its axis. On the 9th, the same group appeared just within the western limb, the three largest spots elongated and the faculæ very marked. Two pairs of small spots were also seen following the group, one above and the other below the sun's equator. On the 12th, all the spots seen in the last picture had disappeared except the lower pair, which had increased in size. On the 15th, appeared another pair, of about the same size as those last seen, and a single spot just within the eastern limb. On the 16th, the same spots, with another nearer the eastern limb, and on the 17th still another at the east and lower. On the 19th, no change was perceived except that caused by the sun's motion.

Barometer and Thermometer.

The meteorological journal from Sept. 20 to Oct. 17 gives the highest barometer, Oct. 15, 30·36; the lowest barometer, Sept. 29, 29·46; the highest thermometer, Sept. 25, at 2 P. M., 78°; the lowest thermometer, Oct. 15 at 7 A. M., 27·5°.

Amount of Rain.

The rain which fell during Sept. 20 amounted to 1·8 inches.

The rain which fell during the night of Sept. 28 and the day of Sept. 29 amounted to 0·42 inches.

The rain which fell during the day of Oct. 2 amounted to 0·11 inches.

The rain which fell between the night of Oct. 6 and the morning of Oct. 9 amounted to 1·5 inches.

The rain which fell during the night of Oct. 9 and the day of Oct. 10 amounted to 0·21 inches.

Effect of Gases in the Coagulation of the Blood.

MM. Mathieu and Urban give the following conclusions as the results of their studies into the above subject: Blood deprived of carbonic acid by exosmose or by any other process does not coagulate until it regains the gas thus lost. The affinity of the blood globules for carbonic acid is evident. The coloring matter of the blood fixes the gas as readily as it does oxygen. Both oxygen and carbonic acid gases are occluded in the red globules. The coagulation of the blood by supersaturation is produced in pulmonary asphyxia, after a stoppage or extreme slowing of the circulation and after inflammation. The examination of different processes of spontaneous coagulation happening during life establishes a relation between the formation of fibrinous clots and the accumulation of carbonic acid in the blood, or the alteration of the organs charged with the elimination of the same.

Correspondence.

The Plumber's Defence.

To the Editor of the Scientific American:

Bearing cheerful testimony to your general fairness, candor, and good nature, it is to be regretted that they have failed you in treating this tender subject. Our unfortunate occupation seems to have achieved a painful and unenviable prominence of late, by being made the target of savagely jocose and furiously sarcastic attacks.

Just complaints of the imperfect work of plumbers may be accounted for by the amazing want of judgment the owner of a house containing modern improvements displays in the selection of a plumber. If he becomes the owner of a horse, the blacksmith who shall shoe him is chosen after a most thorough investigation into his merits, and after consultation and advice with posted friends. If he be the possessor of a fine watch, the artificer who shall regulate, clean, and repair it is selected with great care, and on no account will it be entrusted to a new or unknown party. But if the same man builds a new house, or buys an old one requiring repairs to its plumbing, straightway he rushes round to search after—the best plumber? Far from it. He has heard that all plumbers are robbers, and he is going to find a cheap man if it takes a month. Of course he succeeds, and of course he gets a botched job. Or, more fatal blunder still, purposing to save bother, he permits or requires the builder to include plumbing in his estimate, thereby making it to the strong interest of the builder to put in the cheapest plumbing that will pass inspection.

No one but an expert can tell by inspection whether plumbing is well or ill done. The incompetence of architects and building superintendents in this respect is well known and frankly confessed by the best of them, who do not feel obliged (as third rate men generally do) to know everything. The writer has known of pipes one and two grades lighter than the specifications called for being put in under the very eyes of architects, who were thoroughly honest and could not have been suborned to wink at the evasion had they known it.

The employment of the cheapest mechanics who can be made to pass muster and the too rapid pushing of the work make it impossible to thoroughly test the material and workmanship as it progresses. Solid or leaky joints are not the worst, though perhaps they are the most annoying, effects of a bad job of plumbing. They are apparent at once, and the contractor is obliged to put them in order; but a job put up with light or inferior material runs very well for a while, until constant expansion by continued pressure produces a burst. This is no sooner repaired than another appears, and another, and the jobber who has been called in (and who may be an entirely different party from the one who did the original job) gets all the blame of not being able to "fix a pipe so that it will stay fixed."

Much complaint is made of the exorbitant charges of plumbers, mainly in jobbing or small work. As honest mechanics do not make exorbitant charges any more than honest men pick pockets, it only remains to explain why honest charges are sometimes high. A customer calls to say that a faucet is out of order. Desiring to find out accurately what is to be done, you ask how it operates: "Oh, it just drips constantly; won't shut off!" "Well, does it turn to a stop, or will the handle revolve continually?" He "don't know." You suggest sending a new faucet, in case it should be needed. With a look of excessive sharpness, he exclaims: "No, you don't. Your men would soon find a way to make it necessary. A little packing is all you want." As a decent self-respect stops argument here, the workmen are sent out. Upon reaching the job (perhaps miles away), the thread is found to be stripped or the wings worn off, and the faucet worthless. The helper is dispatched for a new one and the time charged. When the bill is presented, the agony is fearful. "Your man just sat around and talked to the girls, while the boy went after something. Do you suppose I am going to stand that?" Another customer drops in and says that his wife wants a plumber sent up. "Don't know what's the matter. Reckon its something about the cocks." A man with proper tools for soldering, packing, etc., is sent up, and finds that a water closet or drain is choked, or perhaps that the gas leaks; and the tools he has (usually a good load) are not at all that he needs. More delay and more of the running, which so exasperates the unfortunate customer. Who is to blame?

It is true that much incompetence and dishonesty do exist, and probably will until competence and honesty are better paid. The mechanic who promptly, faithfully, and carefully looks after his work is worthy of his hire, even if the price is a little higher than that of the incompetent and careless. Probably the touchstone of the whole matter is contained in your aspiration for "a plumber who will do his work well at a moderate cost." If a man thoroughly and faithfully superintends his workmen, he is no more responsible for the original cost of his work than his customers are. His materials, of lead, iron, brass, and copper manipulated to a high degree, are expensive in the nature of things, and bills including these will necessarily be large. If your wish could be modified to a desire for a plumber who will faithfully execute his work and be content with a reasonable profit, it may be confidently expected that by patient searching you will find him out.

When it becomes the practice to bestow upon honesty, ability, and industry the premium which they earn and deserve parties who can "fill the bill" will abound.

I feel that the spirit of the foregoing remarks has a wider range and larger application than the immediate subject of discussion. C. C. Dewstoe.

Cleveland, Ohio.

The Machinery at the Fair.

To the Editor of the Scientific American:

Your correspondent "Esor," writing in your issue of October 17, concluded his remarks, in regard to an axle lathe of our manufacture, as follows:

"On the tool post, however, is a taper washer, by means of which to regulate the hight of the turning tool. With such a washer, it is impossible to put this lathe to the full duty it will perform, because, the face of the washer not being parallel or level with the face of the holding screw, the tool is not so firmly clamped as a heavy duty will require. The centers are not yet turned up, indicating that it is not intended to put any work on the lathe, an omission to be regretted."

We take no offense at just criticism; but we beg to demur to the statement that "it is impossible to put this lathe to the full duty," etc. Very nearly two hundred and fifty of these lathes, built by us in the past thirteen years, all with substantially the same arrangement for adjusting and holding the tool, have been put into operation in the United States, Canada, Cuba, and South America. No complaint has ever reached us as to difficulty in holding the tool.

Twenty complete and well fitted axles have in a number of shops been turned on one lathe in ten hours; even this has been exceeded in some instances; in one case, twelve were turned in five hours. This we consider tolerably "heavy duty," and think the tool must have been "firmly clamped" at pretty short intervals, without much delay or difficulty.

As regards the omission to put work into the lathe during the exhibition, it would plainly be impracticable, in such a place, to supply it with material, even for a small proportion of the time: a circumstance which we regret as much as any one. Wm. B. Bement & Son.

Philadelphia, Pa.

Rapid Railway Traveling.

To the Editor of the Scientific American:

A train consisting of three cars, drawn by engine 97, driven by Joseph Losey, ran from Easton, Pa., to Jersey City, a distance of 74 miles, in 79 minutes running time, an average of 56¼ miles per hour. This does not show full speed, as three stops were made; and although I have deducted the actual time that was lost at the stations, there has been no allowance made for slowing down and getting under headway again. The distance from White House to North Branch, $4\frac{3}{10}$ miles, was run in exactly 4 minutes. The road between the last named points is comparatively straight and level; the time was taken accurately at both stations, and by stop watches on the train.

The engine, an anthracite coal burner, was originally of the Grant pattern, with 16 inch cylinders. She has been rebuilt, and her cylinders now are 17 by 22 inches, and her drivers are 5 feet 10 inches over the tyres.

Hampton Junction, N. J. Charles Ward.

The Eucalyptus and the Phylloxera.

To the Editor of the Scientific American:

I have been informed that the Tasmanian blue gum tree (*eucalyptus globulus*) is acclimated in the southern portion of France. In that territory, possibly in the immediate vicinity of trees of that species, there are large numbers of cultivated grapevines. Perhaps it would be well to examine the grapevines so located and ascertain if they are exempt from the ravages of the phylloxera. The blue gum trees appear to be suitable for the vineyard: they grow rapidly, straight, and firm, and would afford an admirable support for the wire; they cast no injurious amount of shade, and are known to be an antidote for that vapor of parasites called miasma.

New York city. Robert Bruce Stuart.

Cable Telegraphy.

To the Editor of the Scientific American:

In your last issue you print a paper read before the British Association by W. K. Winter on an improvement in cable telegraphy.

Allow me to state that the principle shown was invented by myself and patented both in England and this country some three years ago. It is used by the Automatic Telegraph Company of New York. Thomas A. Edison.

Newark, N. J.

The surgeons of the Hotel Dieu at Montpélier, France, have had for some time past a queer case on their hands, of a young man who swallowed a fork. The fork still remains somewhere in the body, and, strange to say, occasions no particular inconvenience to the patient, although over a month has elapsed since the accident took place. At the same hospital an individual, while in a state of delirium, lately ate a thermometer, glass and all. The doctors are sorely perplexed for a way to extract the intruding objects.

A recent patent for a map consists in having those portions intended to represent the rivers, lakes, and oceans filled with actual water. This is done by attaching the map to a back of wood of sufficient thickness. The rivers, etc., are dug out, filled with water, and glazed. Such maps may be hung upon the wall in the usual manner.

PRACTICAL MECHANISM.

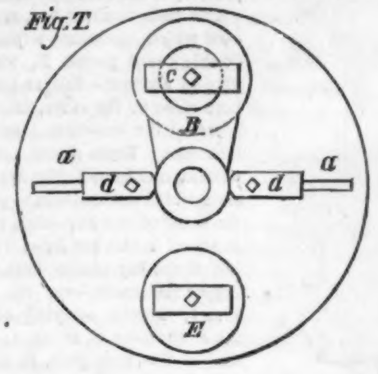
NUMBER XII.

BY JOSHUA ROSE.

TURNING CRANKS.

A crank having a plain surface on its back should have such surface planed true. The large hole should be bored first, the crank being clamped with its planed surface to the chuck plate of the lathe, when the hole may be bored and the face of the hub trued up. To bore the hole for the crank pin, clamp the face of the hub of the crank, which has been trued up, against the plate of the lathe (the crank pin end of the crank being as it were suspended); then bolt two plates to the chuck plate, one on each side of the crank at the end to be bored, and place them so that their ends just come in contact with the crank end, as shown in Fig. T, *a a* being

Fig. T.



the chuck plate, B the crank, C the clamp holding the turned face of the inside hub of the crank to the chuck plate, and *d d* the plates steadying the end of the crank to be bored, so that it shall not move its position on the face plate (or chuck plate) from the pressure of the cut, and E a weight bolted to the chuck to counterbalance the heavy end of the crank. It is obvious that, if the crank be a heavy one, two or more plates may be used in place of the plate or clamp, C. A crank chucked in this manner will be practically true providing the chuck plate be true, even if the cut taken off the back by the planer were not true, or even though there had been no cut taken off the back, and the crank had, in consequence, been sprung in the first chucking; because the face of the hub (or boss, as it is sometimes called) will, under any circumstances, be true with the hole, both having been turned at one chucking; and even if the crank were twisted in chucking, the face will follow the hole and remain practically true with it. This face, being in the second chucking bolted to the face plate of the lathe, will be held as true as is the face plate, and cannot spring from the pressure of chucking; neither can the crank pin end spring in the second chucking, because it does not receive any strain from either bolts or clamps. Furthermore, if the face plate is out of true across its face (that is, hollow or rounding), the last hole bored in the crank will, if chucked in this manner, be out of true to only the same degree as is the face plate.

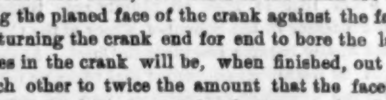
If, on the other hand, both holes of the crank are bored by clamping the planed face of the crank against the faceplate, merely turning the crank end for end to bore the last hole, the holes in the crank will be, when finished, out of true with each other to twice the amount that the faceplate of the lathe is out of true, or to twice the amount that the planed surface is itself out of true, from being sprung in chucking on the planer, from having its skin removed, or from other causes. If the face plate of a lathe is known to be hollow or round in the plane of its face, a piece of paper or other substance, of the thickness necessary to compensate for the defect, may be placed behind the crank and between it and the face plate, in the position requisite to effect such compensation.

Weights sufficient to counterbalance the overhanging end of the crank should be bolted to the face plate on the side opposite to such end, as shown at E, Fig. T.

BALL TURNING.

The best method of turning balls, such as are sometimes used for the valves of pumps, is as follows: The ball should be cast with two round stems on it, so that the stems can be placed between the centers of the lathe while the ball is roughed out, which may be done by a front tool for brass, cutting the ball down to within $\frac{1}{16}$ inch of the required diameter, and gaging it as nearly round as can be done by the eye and a pair of callipers. If, however, there are several balls to be turned, a gage may be made by filing out a segment of a circle (equal to, say, $\frac{1}{4}$ of its circumference) in a piece of sheet iron about $\frac{1}{32}$ of an inch thick. After the ball is roughed out, the stems must be cut off, care being taken not to cut them off too deep. The next operation is to chuck a block, of tin or of equal parts of tin and lead, and to bore a hole in it equal to about $\frac{7}{8}$ of the diameter of the ball, into which hole the ball may be lightly tapped with a piece of wood, so that the chuck will revolve the ball and hold it sufficiently firmly to admit of its being scraped by a hand scraper, shown in Fig. U, *a* being the cutting edge.

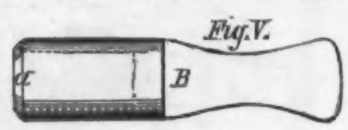
Fig. U.



The ball should be so placed in the chuck that the scraper marks will cross the turning marks already on the ball; and the scraper may then be applied, taking off just enough to take out the marks left by the tool when the ball was turned between the centers. The ball is then taken from the chuck by tapping the former lightly with a piece of wood, and is replaced in the chuck in such a position that the part of the ball which has just been scraped will now be inside the chuck, when the exposed half of the ball may be in turn trued up with the scraper; which being done, the ball is again removed from the chuck and replaced in such a position that the turning marks will be directly across the previous ones on that half of the ball, the scraper being then applied in the same manner as before. The ball being again removed from the chuck and replaced so that the part last scraped will be inside the chuck, the process of scraping is repeated, when the ball will have been made round except in so far that some of the scraper marks may be a little deeper than others. The positions in which the ball has been turned during the four chuckings may be clearly understood by making a comparison of the ball to the earth, the stems representing the north and south poles. The turning marks made while the ball was between the latter centers will be in the same relative position as the lines representing longitude. The first two turnings in the chuck will leave the turning marks in the same relative position, as the lines representing latitude, and the second two turnings in the chuck will again represent the lines denoting longitude. The operation of scraping may then be repeated, the ball being reversed indiscriminately in the chuck and scraped very lightly and as evenly as possible, after which the ball cutter may be applied.

A ball cutter is a hardened steel tube with its outside edge beveled off so as to cause the inside edge to form a

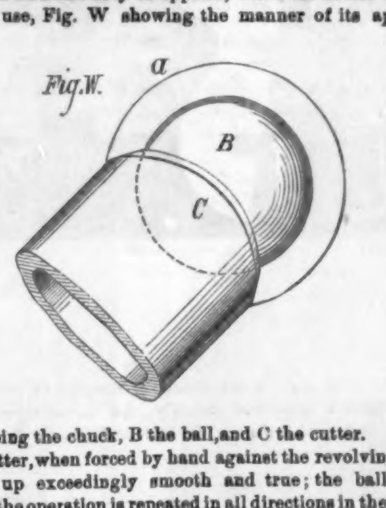
Fig. V.



cutting edge, as shown in Fig. V, *a* being the cutting edge and B the handle. It should be made as follows: A piece of cast steel tube about 4 inches long must be bored out, true and smooth, to a bore equal to about $\frac{3}{4}$ of the diameter of the ball it is intended to cut. The outside of the tube must then be trued up so that the metal will be of equal thickness all over, which will render the tube less likely to warp during the process of hardening. The end of the cutting end of the tube must be beveled as shown in the illustration when the tube must be taken from the lathe and hardened right out, care being taken to dip it endwise and evenly in the water, so that its contraction in cooling may be even, which will reduce to a minimum its liability to crack or warp.

The next operation is to grind it out true again, for the bore is almost certain to have warped a trifle in hardening. The grinding is performed by a lap in a manner to be described in remarks upon laps and lapping. The lapping being completed, the handle may be fitted to the tube and the cutting edge ground on a grindstone, taking care to only grind sufficient off the beveled edge to sharpen it, and revolving the cutter so that it will be ground evenly and smooth. The cutting edge should stand at a right angle to the bore, and may be gaged by applying a square to the outside and across the cutting edges of the cutter. The grinding completed, the oil stone may be applied, when the cutter will be ready for use, Fig. W showing the manner of its applica-

Fig. W.



tion, *a* being the chuck, B the ball, and C the cutter.

The cutter, when forced by hand against the revolving ball, trues it up exceedingly smooth and true; the ball being reversed, the operation is repeated in all directions in the chuck which may be; done without stopping the lathe, and then continued until the ball is true, which may be readily known, because the cutter will cut the high parts of the ball easily, taking off large shavings; but when the cutter edge bears equally at all parts on the ball, it will scarcely do more than polish it. When the ball is nearly finished, but a slight pressure must be placed upon the cutter, and the ball must be more frequently reversed in the chuck.

TURNING PISTONS AND RODS.

A piston should first be bored to receive the piston rod. The next operation is to rough out the body of the piston rod and to then fit it to the piston. The piston is then made fast to the rod, by the key, the nut, or by riveting, as the case may be and the piston and rod should then be turned between the centers. By this means, the piston is sure to be true with the rod, which would not be the case if the piston and rod were turned separately. In turning the piston follower, that is, the disk which bolts to the piston head to retain the rings in their places, slack back the dogs or jaws of the chuck after the roughing out is complete, taking the finishing cuts with the jaws clamped as lightly as possible upon the work; because when the jaws of a chuck are screwed upon the work with great force, they spring it out of its natural shape.

PISTON RINGS.

The rings of metal from which piston rings are turned should have feet cast upon one end, which feet must be faced up true by taking a cut over them. The ring should then be chucked by bolting the faced feet against the chuck plate, so that the ring shall not be sprung in chucking, as it would be if it were held upon its inside or outside diameter by the jaws of a chuck. The inside and outside diameters of the ring may then be turned to their required dimensions, and the end face may be trued up, when the piston rings may be cut off as follows:

First introduce the parting tool, leaving the ring sufficiently wide to allow of a finishing cut after cutting the ring nearly off; introduce a side tool, shown in Fig. 22, and take a light finishing cut off the side of the ring, and then cut it off. The end face of the ring in the lathe may then be trued up by a finishing cut being taken over it, when the parting tool may be introduced and the process repeated for the next ring.

Piston rings are sometimes made thick on one side and thin on the other side of the diameter, the split of the ring being afterwards cut at its thinnest part, so that, when the ring is sprung into the cylinder (which is done to make the ring fit the cylinder tight and to cause it to expand as it wears, thus compensating for the wear), its spring will be equal all over and not mainly on the part of the diameter at right angles to the split, as it otherwise would be.

The process of turning such rings is to face the feet of the ring from which they are to be cut, and then turn up the outside diameter to its required size. Then move the ring on the face plate sufficiently to cause it to revolve eccentrically to the amount of the required difference between the thickest and thinnest parts of the ring, when the inside diameter should be trued out, and the rings cut off as before directed.

The object of turning the inside bore after and not before the outside diameter of the ring is turned, is that, during the process of cutting off the individual piston rings, the bore of the ring will be true, so that the parting tool will not come through the ring at one side sooner than at the other; for if this were the case, the parting tool, from its liability to spring and its broad cutting surface (parallel to the diameter of its cut), would be apt to spring in, rendering the cutting off process very difficult to perform; because if the piston ring is cut completely through on one side and not on the other, it will probably bend and spring from the pressure of the parting tool, and in most cases break off before being cut through at all parts by the tool.

The inside diameter (or bore) of piston rings is frequently left rough, that is to say, not turned out at all; but whenever this is the case, the splitting of the ring will in all probability cause one end of the ring (where it is split) to move laterally one way and the other end to move the opposite way, causing the vise hand a great deal of labor to file and scrape the sides of the ring true again. The cause of this spring is that there is a tension on the inside of the ring (where it has not been bored), tending to twist it, which tendency is overcome by the strength of the ring so long as it is solid; but when it is split, the tension releases itself by twisting the ring as stated.

Cider.

This is the month when fine clear cider may be made, but later in the year perhaps the best cider is made. To have good cider, says the Maryland *Farmer*, the apples ought to be sound, clean, and somewhat mellow, and there should be perfect cleanliness in all the operation of grinding, etc. The barrels ought to be clean and free from all taint or bad smell. Keep the barrels full, during fermentation, with cider of the same making kept for the purpose. As soon as it ceases to actively ferment, draw it off into other barrels and at the same time strain it through a blanket or muslin—common cotton—and when it ceases fermenting, add to it 4 lbs. of mustard seed or as some recommend, sulphite of lime; then bung down.

A small gimlet hole might be bored through the bung to let off for a few days any excess of gas, and then stopped up tight. To have it extra fine, it should be racked off the third time. Good cider always commands a high price, and it is admitted to be a wholesome and temperate beverage.

KEEPING APPLES.

A correspondent of the Boston *Cultivator* kept 1,200 barrels of apples, mostly Baldwins, in his cellar last winter, by daily expelling the stagnant air and replacing it with pure. He attributes the early decay of apples largely to a vegetable miasma in the air, which is communicated to it by vegetable evaporation under certain conditions. The effect of this miasma is first seen in minute specks on the apple.

AN unfortunate trouble exists between the proprietors of the Troy, N. Y., iron works and their puddlers, owing to a reduction in the wages of the latter. The puddlers have refused to accept the reduced wages. A dead lock consequently prevails. If the puddlers do not accede to this new scale of wages, the whole works threaten to shut down. This is not a pleasant prospect in view of the nearness of winter.

A SPECIMEN of the ore recently taken from the new silver mine at Wolcottville, Conn., contained from eight to ten ounces of silver to a tun, with a small percentage of gold. An effort is being made to form a joint stock company, for the purpose of developing the mine.

IMPROVED STUMP SAWING MACHINE.

Settlers in wooded districts of the West, or farmers generally, who contemplate clearing off some of their timbered land during the present fall or in the spring of the coming year, will find in the annexed engraving a new saw represented, which will, without doubt, prove an efficient aid in accomplishing the labor of cutting off the stumps. The blade leaves the stumps with a concave top, which serves to retain moisture, so that the rotting of the lower wood is considerably facilitated, while the division may be made as deep as six or eight inches below the surface of the ground if it be desired.

An ordinary saw is employed, sprung in arc shape and clamped to the ends of a swinging frame, A, which is applied by a central sleeve to a smooth shaft, sustained in a supporting frame. The saw frame is provided at its ends with handles so as to be worked by one or two men. A cord attached to its center passes over a pulley, B, on the supporting frame, and carries a weight which produces the forward feeding of the saw into the stump.

The supporting frame consists simply of inclined legs pivoted to and secured by nuts on the ends of the horizontal shaft. The elevation of the latter above the ground and the consequent raising or lowering of the saw is provided by spreading the legs and fastening them in the required position by arc-shaped guides, C, and set screws. The lower ends of the legs are connected longitudinally by base runners, D, in order to gain increased stability to the frame, and to admit of steadier seating on the ground. Suitable handles on the legs serve to carry the machine from stump to stump.

The mode of arranging the apparatus, its size, and various other points of detail are plainly indicated in the engraving and require no further explanation. The inventor states that he has used the device with perfect success, cutting off the stumps below, even with, or above the ground with rapidity and ease.

Patented through the Scientific American Patent Agency, September 8, 1874, by Mr. James A. Elston, of Elston Station, Cole county, Mo., to whom letters for further information may be addressed.

Bronzes of Copper and Tin.---The Chinese Gong Metal.

Bronzes containing from 18 to 22 per cent of tin, heated to redness and suddenly cooled by plunging into cold water, have their density increased by the process; but when a specimen which has been so treated is again heated to redness and annealed, or very slowly cooled, the density is reduced. The latter effect is much less marked than the former and a piece of such bronze, subjected alternately to sudden and to slow cooling, has its density notably increased by a few repetitions of the operations. This result does not occur when a bronze containing only from 6 to 12 per cent of tin is submitted to the same series of processes. When alternately, either with annealing or with sudden cooling, the sample is submitted to such mechanical operations as simple compression, the stroke of a coining press, or, in the case of bronzes poor in tin, to extension in a rolling mill, the density of both classes of bronzes is augmented. Both the mechanical and heating actions contribute to this effect, which, in bronzes rich in tin, is more marked with sudden than with slow cooling. Bronzes rich in tin are softened by sudden cooling, while the reverse effect is produced in steel, in which also the density is diminished by the operation, instead of being increased, as in the bronzes.

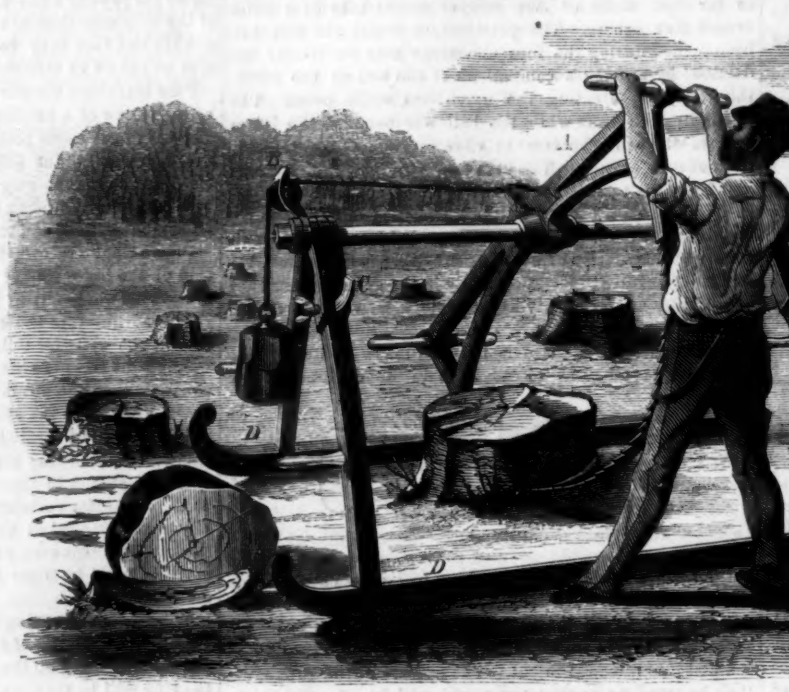
A discovery of considerable industrial value is announced in Mr. Riche's paper. It is known that bronze containing about 20 per cent of tin cannot be wrought at ordinary temperatures, and that at a bright cherry red heat it crumbles under the hammer. The author has, however, found that at a dark red heat, or a little below it, this alloy is as malleable as iron, and may be hammered into thin plates with the greatest ease. Availing himself of this observation, he has been able, in conjunction with M. Champion, to fabricate gongs, which are, in chemical composition, external appearance, and sonorous properties, identical with the famous Chinese instruments.

Facts about Copper.

Mechanical actions, alternating with either slow or sudden cooling, produce in pure copper an increase of density when the heating has taken place without access of air, and a decrease in the contrary case. Brass has its density increased by sudden cooling and by mechanical actions, but diminished by annealing; while similor, which contains a much smaller proportion of zinc, undergoes no sensible change of density by these processes. Some experiments are described, proving the permeability to liquids of cast iron, by Mr. Riche, who finds that copper melted and run into the mold at a low temperature is also capable of absorbing liquids, a property acquired likewise by rolled copper after heating in charcoal. This property is not possessed by copper which has been cast at an elevated temperature, or heated with access of air, or alloyed with a small quantity of iron. The introduction of a small quantity of iron greatly increases the tenacity and hardness of copper, without interfering with its malleability.—*Journal of the Chemical Society.*

A Mine of Liquid Sulphur.

In the vicinity of San Martino, near Palermo, Sicily, a mine of liquid sulphur is being worked, or, in other words, large collections of the substance are being made at points where it flows from the fissures in the rocks in quantities of from 400 to 500 hundredweight per day. The sulphur comes from a burning mine within the mountain; and in order to give it time to cool, so as to admit of gathering it, the outlets are frequently closed for brief periods. Quite recently, on opening one of these closed fissures, it was found that the sulphur had disappeared; and in order to renew the flow, it was suggested to tunnel down toward the mine. Hardly was the work begun, however, before the pressure in rear of the obstructing mass became too great for the latter to withstand, and a terrific explosion ensued, hurling the workmen into the air, killing five and badly wounding six more.



ELSTON'S STUMP SAWING MACHINE.

MOAT'S IMPROVED LOCK.

The peculiar feature of the novel lock illustrated herewith is that no key, unless specially adapted to performing three distinct functions, namely, the throwing of a main tumbler and guard plates, the bolt, and the latch tumbler, can possibly open it. This will be more evident from the fact that the key holes are closed by guard plates before the motion of the other parts takes place, so that the introduction of implements for throwing the bolt and releasing the tumblers is at once prevented. The action of the key on the parts of the lock, in either direction, is the same, so that no intermeddling or tampering with the open lock is possible.

Fig. 1

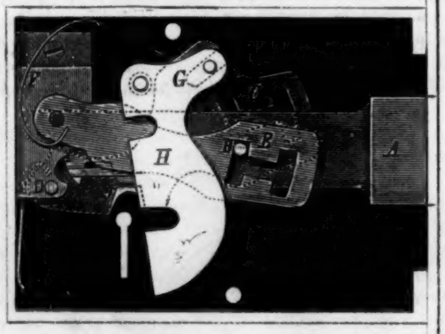


Fig. 2

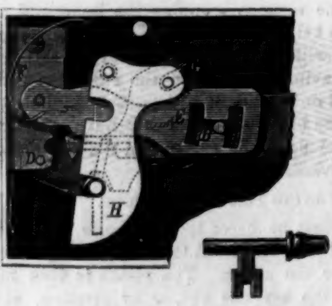


Fig. 3

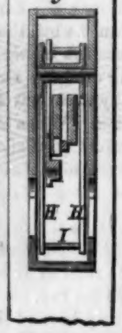


Fig. 1 shows the position of the working parts with the key hole open, and Fig. 2, the same with the guard before the latter. Fig. 3 is a vertical transverse section of Fig. 1. The form of the key is represented beside Fig. 2. A is the bolt, which is thrown by the key engaging in a recess at the rear part of the same. By means of pins, B, on each side, the bolt connects with the double T-headed slots shown in the main tumbler, C, which is pivoted at D and acted upon by the adjacent band spring, and in the latch tumbler, E, which is thrown by its separate spring, F. The tumblers, it will be observed, are thrown in opposite directions, so as to lock over the stop pins, B, of the bolt.

The main tumbler has, at G, a recess which embraces a pin of the double guard plates, H, which are pivoted above the bolt, and swing at both sides of the same, immediately under the outer side plates of the lock case. These plates are braced with lateral bars, I, Fig. 3, and have slots which enable them to pass over the stem of the key when the same is placed in the key hole. The turning of the key causes, first, a catching of the spurs over the part, J, Fig. 1, thereby carrying down the main tumbler, C, so as to release one of the stop pins, B, from the slots in said tumbler, and to throw the guard plates, H, around the key stem, thereby closing the key holes completely. The key next engages with the bolt recess (see dotted lines, Fig. 2), and raises also the latch tumbler, E, from the opposite stop pin, B, so that the bolt is free to be thrown for closing or opening the lock. The spring action on the main and latch tumbler carries them instantly, on the completion of the bolt movement, back over the stop pins, and throws the guide plates sidewise from the key holes, producing thereby the rigid and secure position of the bolt, besides the opening of the key holes for the key.

Patented through the Scientific American Patent Agency, August 25, 1874. For further information address the inventor, Mr. E. Moat, Watertown, Mass.

Elie de Beaumont.

The death of the oldest of French statesmen, M. Guizot, is closely followed by that of Elié de Beaumont, the greatest as well as one of the most aged of French geologists. M. de Beaumont was born in 1798; and after successfully conducting an extended series of metallurgical explorations under government auspices, he became in 1824 a mining engineer. From 1829 to 1833 he rapidly rose through the position of Professor in the School of Mines of the College of France, and finally became Engineer-in-Chief. At the death of Arago, M. de Beaumont succeeded that *savan* as perpetual secretary of the *Académie des Sciences*, and he was subsequently made a senator of the empire by Napoleon III.

M. de Beaumont's labors have resulted in the publication of several works, in one of which he endeavors to prove that mountain chains are to be classed according to the direction of their range, all those lying parallel with the same great circle of the earth, wherever they may be found, having been uplifted suddenly during the same geological epoch. The features of no fewer than ninety-five systems of mountains are accurately described in the last edition of this book. His geological researches in France have added largely to the knowledge of the resources of that country, as well as to general learning in the science. M. de Beaumont died on the 24th of September last.

Progress of Telegraphy in the United States.

The annual report of the Western Union Telegraph Company, just published, shows 175,135 miles of wire, and 71,585 miles of line in use, with 6,188 telegraph offices. The total receipts for the year were $9,262,653; expenses, $6,755,733. The Stearns Duplex telegraph apparatus, by which messages are sent both ways on one wire and at the same time, are in extensive operation.

But the past year has produced an invention still more wonderful than the duplex. Thomas A. Edison, and George B. Prescott, the electrician of the company, have discovered processes and invented apparatus by means of which two messages can be sent in the same direction, and two others in the opposite direction, simultaneously upon one and the same wire. This invention, which they have christened the quadruplex, is in successful operation between the New York and Boston offices, and is satisfactorily performing an amount of work upon one wire quite equal to the capacity of four wires worked with the ordinary Morse apparatus: so says the president.

A NEW device for registering the fares of street railroads has been introduced in Philadelphia. It is a portable receptacle for money or tickets, and resembles in size a large powder flask. The conductor presents the machine to the passenger, who puts in his fare in cash or a ticket, whereupon the conductor presses the spring, which works the register and sounds an alarm bell.

THE SOUTHPORT AQUARIUM AND WINTER GARDEN.

A few miles to the north of Liverpool, on the Lancashire coast, England, is a newly grown watering place, Southport. Its beauty and salubrity have gained it renown among the inhabitants of the scores of manufacturing towns in its immediate neighborhood; and it has become a very popular resort, being within a short railway journey of the homes of many millions of people. The Southport folks have recently embellished their town with a building comprising an aquarium, a winter garden, a music hall, and a large covered promenade. The conservatory or winter garden, shown in our Fig. 1, is a large and graceful structure of iron and glass, and contains not only a fine collection of rare tropical and other plants, but also birds and animals, making a nucleus for an extended zöological exhibition. This has been wisely entrusted to the care of Mr. Frank Buckland, the friend of all living creatures and the editor of *Land and Water*.

The aquarium, Fig. 2, is excellently arranged, being mainly lighted through the tanks containing the specimens, so that they may be seen to advantage. It is a solid and imposing structure. The exterior of the building, with the entrance gates and a portion of the grounds, are shown in Fig. 3.

"The edifice," says Mr. Buckland, "must be inspected to obtain an idea of its beauty. In general outline it reminds us of the Crystal Palace. One side only of this crystal palace is at present in existence, but there is ample space (now occupied by houses) to complete the other wing.

Adjoining the dome is a promenade, which at the night of opening was so full that it was almost impossible to move about. On the walls of this were exhibited some of Mr. Rolfe's fish pictures. Here also was exhibited a salmon caught by the rod in the Ness, 32 pounds in weight. I cast him. Mr. Rolfe painted him in his best style, and we conjointly had the pleasure of presenting him to the aquarium. He is represented as lying in a basket on straw, and the deception, to those who had never seen Mr. Rolfe's works before, was very satisfactory, the difficulty being to prevent people from tapping the fish to see if it was real. A glass case is being prepared for its reception.

The aquarium cannot be seen from above ground. The space underneath the winter garden is entirely occupied by an immense tank for sea water; it communicates with two other tanks which are used as occasion requires.

The sea water is supplied from the public baths, whence it is conveyed by means of a pipe; abundance of water is available from this source. The aquarium itself is partly under the promenade and partly under the winter gardens. Under the promenade are twenty-two tanks, the light being let in from the top by day, and illuminated by gas at night.

The fish in the various tanks are as follows: Congers, ling and codling, mullets, father lashers, sea trout, wrasse, anemones and whiting, dog fish, gurnards, crayfish and crabs, whiting, rays and soldier crabs, soles, turbots and flukes, monkfish, topers, lobsters, king crabs, octopus, *Maia squinado* and edible crabs, stickle-backs and anemones, bass or sea-perch, cod, salmon, great lake trout, and gold schlei or golden tench, and large dog fish.

SOUTHPORT, ENGLAND.—Fig. 1.—THE CONSERVATORY.

Fig. 2.—THE AQUARIUM.

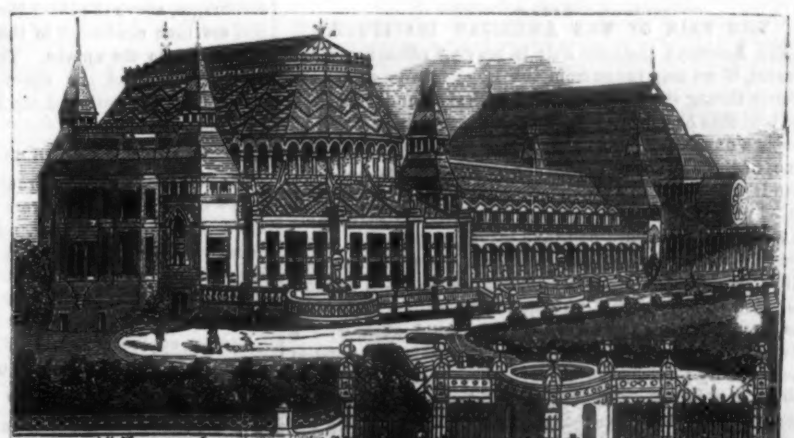


Fig. 3.—EXTERIOR OF THE BUILDING.

There are also some very handsome table tanks and aquaria, containing collections of anemones, gobies, fifteen spine sticklebacks, prawns, and Norway lobsters. Orders and regulations have been laid down by the board as to feeding the fish, cleaning the tanks, etc. There is a seal tank, and some fine specimens of the sea trout.

AN Illinois editor returns thanks for a centipede sent to him by mail from Texas, "it being," he says, "the first cent of any kind that we've received for several weeks."

SULPHUR IN SICILY, AND ITS REDUCTION FROM THE ORE.

BY PROFESSOR G. VON RATH.

The strata in which the sulphur occurs belong to the tertiary formation, and, according to Mottura, to the miocene epoch. They extend over a large portion of the island, the greatest length from east to west being about 100 English miles, and the greatest breadth, 53 to 56 miles. Within this large tract, the sulphur formation appears in groups. The oldest rocks of this tract are sandstone, which rest upon gneiss and slate. On these sandstones are marl beds, which resemble keuper marl; then follow limestones both jurassic and cretaceous, and eocene nummulitic limestone, with a peculiar porous limestone in crags and ridges. On the top of the latter is a foraminiferous marl of marine origin, after which follows a stratum of tripoli, upon which is a stratum of calcareous marl, which is in some places more argillaceous, in others more calcareous. This is the stratum which contains the sulphur. The sulphur formation is generally covered over with immense masses of gypsum, on which again is a foraminiferous marl. Then follows the pliocene formation, blue clay, and yellow breccia.

It is probable that the quite extensive deposits of salt, found in widely distant portions of Sicily, were formed at the same time as the deposits of sulphur. The rock salt enclosed in the clay strata is often very pure. The deposits of sulphur are not usually of great extent, and do not seem to be in immediate communication. The sulphur impregnates the strata of clay and limestone, appearing either in irregular threads and veins, or in layers three to six feet thick, alternating with the layers of rock, or in round concretions from 0·4 to 0·8 of an inch in diameter. Barytes and imperfect crystals of calcspar accompany the sulphur, and, more rarely, beautiful crystals of cœlestine. Sometimes the sulphur strata enclose whole stems of fossil wood. The thickness of the sulphur deposit, in its frequently recurring changes, often remains very constant, and indicates an equally regular change in the conditions under which it was deposited; it almost reminds a person of the changing seasons. The fishes found in the sulphur marl enable us to recognize the sulphurous strata as formed by fresh water.

Parodi states that the average percentage of sulphur in the sulphur rock of Sicily is 12·5 per cent. When it contains less than 6 per cent of sulphur, it does not pay for mining and smelting. In 1871, Sicily produced 150,000 tuns of sulphur, probably nine tenths of that produced in the whole world. This production is continually increasing. That this natural wealth does not prove a greater blessing to the country and its prosperity is principally due to the circumstance that in Sicily the property on the surface cannot be released from that of subterranean treasure, and this circumstance results in a number of other evils, which do not permit mining to emerge from its great and almost inconceivable imperfection.

The number of sulphur mines in Sicily is upwards of 600, not more than half of which are worked at present; and of these, only about 50 are of considerable importance.

In looking for the sulphur deposits, a soft kind of gypsum, formed by the decomposition of the sulphur-bearing lime or calcareous marl, plays an important part. In general, the sulphur is combined with gypsum, and the presence of the latter renders it probable that the former is near. To reach the deposits, inclined shafts are dug, having an inclination of 25° to 50°, seldom steeper, and more seldom horizontal. Neither horizontal galleries nor vertical shafts are employed, since the former would not reach the sulphur soon enough, and the latter would require the use of some sort of machinery; and wood is lacking for this purpose, as also for timbering and frame work. Steps are cut into the inclined plane, and when it is not steeper than 45° the steps reach all the way across; but when steeper, two steps are cut side by side, alternating with each other. The young laborers climb up and down these high, narrow, and slippery steps, panting, groaning, and sweating—carrying on their heads and backs heavy bags filled with sulphur ore. They make from 16 to 18 ascents and descents daily, to and from a depth of over 200 feet.

By this pitiable method, at least a million tuns of sulphur ore are annually brought up into the light of day by boys and youths. Nay, too, the little drippings of water are collected in stone jugs, and brought up in the same laborious manner. The mine is almost always abandoned when it reaches the water level. The temperature in these is very high, 111° Fahrenheit, and, owing to the moisture in the air, it is almost unendurable. The diggers (*picconieri*), owing to the heat, work naked, or only wearing a small apron. The sulphur rock is so soft that it is cut out with a large instrument like an ax. The roof of the mine is supported by pillars, so that a considerable portion of the ore is left standing, to secure the structure. In order to obtain the mass of the pillars, they are weakened more and more, until, at an unexpected moment, the roof falls. The fallen and broken mass is left for a time, until it adheres together; shafts and galleries are then dug through it to get at the pillars. When the sulphur-bearing strata lie one above another, there is a double set of pillars. Through errors in the ground plan and ignorance of mining surveying, it generally happens that the pillars in the upper gallery do not agree with those in the gallery below. As the stone is often soft and brittle, it is no wonder that they frequently break through.

The condition of the sulphur miners is extremely deplorable. The manner of living in populous spots miles distant from each other, instead of in villages, is peculiar to that country, and the majority of the mines are far distant from

human dwellings. Neither manager nor contractor consider it a duty or necessity to erect a roof to protect their workmen, so that they sleep in the open air in pleasant seasons, exposed to the damp dew; while in winter they sleep in the foul atmosphere in the mine itself, exposed to the dangers of being buried alive. In cases of sickness, the unfortunates have no assistance, and the families of those who die, or are killed, are exposed to the greatest misery. As regards education and moral instruction, the working classes are entirely neglected; there are no schools, savings banks, or associations for mutual aid. The consequence is that the society which grows up about the sulphur mines is in every respect an abandoned class, ripe for crime. The mines are a refuge for evil doers from the whole island.

The sulphur is prepared throughout Sicily by melting the stone in *calcaroni*, where the combustion of a portion of the sulphur furnishes the necessary heat to fuse the remainder. The liquid sulphur drips down to the bottom, and flows out into molds intended for its reception. In building a calcarone, a spot is selected at the side of a hill, and a cylindrical furnace built, from 20 to 40 feet in diameter, and a few yards in hight. The walls are supported in the rear by the earth, and in front project in a semi-circular form. The hearth of the furnace has a double inclination, from the hill toward the front and from the sides toward the middle, so that the liquid sulphur collects in one place, and through a perforation in the inner wall it reaches the outlet. The bottom is pounded down hard like a threshing floor. The interior is filled with sulphur ore, the larger pieces being thrown in just as they are, and the smaller ones are formed into cakes, so that the melted sulphur will flow down through it more readily. When the cylinder has been filled, the pieces of sulphur ore are heaped up in a cone above the mason work, and covered with the burned pieces from a previous operation.

A calcarone will hold from 175 to 1,750 tuns. In charging the furnace, several vertical flues are left open, which serve in part for kindling the fire, and in part to keep up the combustion at the beginning of the operation. The pile is ignited by throwing burning wood or bundles of straw down these openings. When the whole mass gets to burning, all the openings are closed; and the operation, which lasts from two to four weeks, according to size, is attentively watched, and the combustion controlled by the cover on the heap. The temperature is kept at a proper hight, above 240° Fah., since sulphur melts at 240°, and remains a thin fluid up to a temperature of 320°. The melted sulphur is drawn off through a hole a foot wide and two feet high, in the front of the furnace, which is previously stopped with clay. The sulphur is run into wooden molds, the bottom and sides of which are moistened so that the sulphur cake will not adhere so tightly.

This method of obtaining sulphur is attended with a great deal of loss; experience shows that the highest yield of a calcarone is 70 per cent, although it does not usually exceed 50 per cent of the total amount of sulphur. The crude sulphur is worth from $1 80 to $2 per 225 lbs., so that the fuel consumed is worth at least twice as much as English coal would cost in Italy.

In producing sulphur in Sicily, only those resources to be found on the spot are made use of: no wood for framing, no machinery for raising the ore and water, no coal for smelting. Any one who would attempt to introduce any improvement in mining or reducing the sulphur would encounter great difficulty, arising chiefly from relations of proprietorship, and in the social status of the country. Legislation is the only help. Notwithstanding the immense store of natural sulphur on the island, it will be seriously impaired, by the progress in other countries which now make oil of vitriol from pyrites, unless some change is effected in the state of affairs.

THE FAIR OF THE AMERICAN INSTITUTE.

The American Institute Fair is proving remarkably successful, if we may judge from the large crowds which constantly throng the building. The display is unquestionably the best that has been made for many years; and since it includes a number of industrial processes carried on in presence of the visitors, it calls forth a much more lively interest than it would were it restricted to mere exhibition of completed products. At one portion of the hall, ivory turners are at work, making billiard balls and carving ornaments; at another a newspaper office is shown in full operation, from the editor vainly endeavoring to seize vagrant ideas—a difficult task, and one we should unhesitatingly decline under the the circumstances, for we doubt if we could work with a bevy of bright eyed damsels staring at us—to the finished sheets deftly piled by the swift-running press. There are tailors cutting out garments by machinery, brush makers manufacturing brushes of all kinds, scroll saws cutting out wooden ornaments and trinkets, engravers making illustrations similar to those in our pages, confectioners cooking candy, and even an old gentleman who cuts your profile likeness in black paper, and does it admirably too, in half a minute, for a small consideration. Up in the Art Department are large volumes, each leaf of which shows an application of one the numerous tints imprinted on a well known chromo. By studying the pages the visitor can learn in a very short time just how the very handsome works of art which Mr. Prang exhibits are made, and how laborious the task must be.

There are a number of interesting shoemaking and leather-working machines in the main hall, and a superb display of leather. Hides tanned by the best American processes are brought in direct competition with those imported from Europe, and the special medals which are offered for excellence have tended to highten popular interest in the exhibition, apart from that excited by its partaking of the nature of an international contest. A new object of curiosity has been recently added in the shape of the winning boat of the Columbia crew at the Saratoga Regatta, last summer. It lays across the hall, gaily decorated with blue and white ribbons. The youngsters seem to be especially pleased with a variety of miniature steam machinery exhibited in operation. There is a steam fire engine which throws a needle-like stream for several yards, steam propellers which travel quite rapidly about a tank of water, and a small machine shop, including lathes, saws, etc., the tools all run by a tiny boiler. Mr. Hawkins, the Superintendent of Machinery, also aims at popularity among the children, for he has lately devoted his ingenious button mold machine to the manufacture of some queer games, which are very interesting, and beside has produced skipping ropes of a remarkable and hitherto unknown pattern.

The Fair as a whole is admirable, and the exhibitors have fairly outdone themselves in the elaborate and tasteful plans adopted in showing their contributions. The management is open to improvement, particularly with reference to allowing the woodworking people to howl their wares like country showmen, to the individual with the perfumery who squirts cold spray into peoples' ears or eyes, and in regard to that ugly drapery on the roof; and there are ridiculous advertisements which talk about "enormous fish" in that little fountain; but generally, however, we find a great deal to praise and very little to condemn.

A recent stroll through the Machinery Department has filled our note book with descriptions of a score or more novelties, some of which below described will doubtless prove interesting.

THE MACHINE TOOLS

of the New York Steam Engine Company are well worth critical examination. Many of them are in actual operation thus affording excellent opportunities for the mechanic to watch their practical employment. There is a chucking and turning lathe, by which a hole can be bored or chucked 20 inches in diameter; and by means of a new slide turning rest, a pulley can be turned, having a diameter of from 8 to 30 inches. This machine has a gap bed. In the upright drills there is a steel drilling spindle attached to a gibbed head which moves up and down with the spindle, giving the latter a very long bearing at every point. A number of machines which have been illustrated in our volumes are exhibited, notably a hand crank drill, a slotting machine, and a gear-molding machine. The shapers have their cutting bars placed on edge in adjustable guides. The vibration or spring of the tool is prevented by placing the widest section of the bars directly opposite the cut. The box-boring machine is arranged so that either of two bars may be used independently. A side rest is provided for each bar, and four boxes in each rest may be simultaneously operated upon. The 9 inch bending rolls exhibited are so constructed as to be kept in constant contact with the plate, and their springing at the centers is prevented. There are a number of other machines of which our limited space necessitates omitting mention.

THE BOILERS,

employed to supply steam to the main engines, are of the Howard safety type. Five tiers of tubes which incline upward to the rear are connected to vertical sections by boring small holes in the extremities of the tubes and allowing the cast metal of the sections to flow in, forming a perfectly solid joint. The parts of the vertical sections are bound together by stay rods passing through and set up with brass nuts; and the caps opposite the parts where the tubes enter are similarly attached by rods passing lengthwise through the tubes. Above the second tier is a fire brick diaphragm, in rear of which the heat passes and then encounters another diaphragm, above the third tier. The products of combustion are then conducted to the front of the boiler, whence they return to the uptake. The three lower tiers of tubes are for water and the upper ones for steam, the latter, through the disposition of the heat, becoming highly heated. There are three

CURIOSITIES IN THE MACHINE DEPARTMENT.

The first is a large tank provided with windows and filled with water. In this the Myers rotary engine is soon to rotate a good sized propeller, and brilliant lights are to be placed so as to shine down and through the water. This is an ingenious way of loading the engine and, besides, showing its adaptability to marine purposes. The tank, however, looks somewhat fragile; extra riveting might improve it.

Another application of the diamond to industrial use is found in the second of our trio of curiosities. It is

THE DIAMOND BAND SAW.

There is little in the construction of this machine, save perhaps its extra heaviness, differing from that of the ordinary woodworking tool. The blade, however, instead of being a single strip of metal, is a band covered with small straps of steel, the latter strung on the former, like beads. In certain straps the diamonds—borts or carbons—are secured so that three straps containing diamonds may come together, and then an interval to the next set occurs of some eight inches. There are of course other ways of arranging the diamonds, which need not here be described. The machine cuts a curve or scroll in stone as easily as the ordinary band saw goes through wood. A certificate published by the inventor, Mr. Herbert Cottrell, of Newark, N. J., says that the blade cut through Newark brown stone, measuring 3 feet 2¼ inches one way and 3 feet 3 inches the other, making a superficial surface of 1,501¼ square inches, in 22 minutes time.

THE ICE CREAM MACHINE

of Messrs. Dixon and Tonstill is the last odd invention of the three. The prepared materials are dropped into a can arranged above like the oil reservoir of a bolt cutter. They flow through a tube into a horizontal cylinder which is placed in a tub and covered with ice and salt. Inside the cylinder is a helicodal knife, which scrapes the edges and also forces out the frozen material through one end. Both cylinder and knife are rotated by simple gearing. It is quite curious to watch the materials enter one part of the machine, and quickly emerge in a frozen condition from another, in the shape of excellent ice cream.

There are two

PIPE CUTTING AND THREADING MACHINES

which deserve notice. One is that of the Chase Manufacturing Company, illustrated on page 131 of our last volume. In this the pipe is held stationary in the vise, and passes through the center of a gear, the rotary motion of which is imparted to the die in the die box by means of guides, upon which the die box freely slides forward as the die passes upon the pipe. When cutting pipe, the tool post, with the cutter, has an automatic feed.

The manufacturers of the other machine are N. W. Frost & Co., of Cohoes N. Y. The apparatus is in three pieces, readily taken apart and put together. One portion forms an excellent vise; another is inserted above and carries the handle and a pinion; and the third is the gear wheel, in which the pinion engages, and which turns the dies and operates the feed. The machine does excellent and rapid work, and is very simple and strong in construction.

THE MAXIM AUTOMATIC PUMPING ENGINE

is a novelty recently added. It consists of a little steam boiler heated by gas, which warms and regulates its own feed and controls the fire. It runs a little pump, placed above, which is said to be capable of forcing from ten to twelve barrels per hour to a distance of one hundred feet, at a cost not over 6 cents.

New Camera Lucida for Drawing.

It is known that the construction of the *camera lucida* is founded upon the simultaneous perception of two images—that of the object and that of the pencil. Various means have been employed to arrive at this result. In that of Sömmering, it is a metallic mirror smaller than the pupil; that of Amici is constructed on the principle of reflection on a plate with parallel faces; that of Wollaston, at present most in use, consists in a prism, of which the edge, dividing the pupil in two parts, permits the object to be seen by the upper half, and simultaneously the pencil by the lower portion. In all these systems the fusion of the images is somewhat difficult to seize, especially for certain points of the reflected image. Govi, Professor of Physics at the Royal University at Rome, proposes to cover with a thin layer of gold the reflecting surface of a prism, and to apply upon this, with Canada balsam, a second prism with like angles. Although this layer of gold is sufficiently transparent to allow the luminous rays to pass, its power of reflection is considerable, and it gives images of great brightness. We have thus a perfect means of superimposing, without fatigue to the eye, two different images—the one direct, and the other reflected. The principle is the application of that property of thin plates—metallic or otherwise—to transmit simultaneously direct rays, and to reflect rays which arrive obliquely from another source.

Dr. Robertson, of Georgetown, Mass., thinks that the popular idea that hot or cold drinks are apt to crack the enamel of the teeth is incorrect. He has ascertained by experiment that it requires a change of temperature of 160° Fah. to crack the enamel of an ordinary tooth. The teeth are never subjected to such a great change as this in the use of hot or cold liquids.

THE first passenger train making the complete circuit of St. Louis lately passed over the bridge and through the tunnel. The regular locomotive being exchanged for one of the smoke-consuming engines used by the tunnel company, the train passed as comfortably as though traveling in the open air.

THE SAW CONTEST AT CINCINNATI.—In our account of the saw premium contest at the Cincinnati Exposition, the 16 good boards, 10 x 20, sawn in two minutes and forty-four seconds, should be described as 16 x 20, making a still greater result than we reported.

THE Canadian way of measuring a tree is said to be as certain as it is grotesque. You walk from the tree, looking at it from time to time between your knees. When you are able to see the top of a tree in this way, your distance from the root of the tree equals its hight.

A LAWYER'S ADVICE TO A PUPIL.—"When the facts are in your favor, but the law opposed to you, come out strong on the facts; but when the law is in your favor, and the facts opposed to you, come out strong on the law." "But," inquired the student, "when the law and the facts are both against me, what shall I do?" "Why, then," said the lawyer, "talk around them."

LEATHER PULP.—A process of pulping leather in engines, similar to those used for beating rags in a paper mill, is now in use in Massachusetts. By rolling it into sheets under considerable pressure, a product of great tenacity, homogeneity, and closeness of texture is obtained, which is, moreover, perfectly waterproof.

Recent American and Foreign Patents.

Improved Harvester.

Andrew Jamison, Taylorstown, Pa.—The feature of this invention is a reel mounted on a pivoted lever, which tilts or raises the finger bar so that it may be adjusted to various hights, thus adapting the machine for use either as a reaper or as a mower.

Improved Steam Bell Ringing Apparatus.

Charles H. Hudson, Dubuque, Iowa, assignor to himself, Pierce B. Sutton, Edwin Smedley, and Orren F. Hodge, same place.—This is a steam engine designed for ringing bells on locomotives. When the bell is in motion, a bell crank will press a tube down on the rod and force the piston to the bottom of the stroke, and thereby close the exhaust and open the inlet ports. When the crank has passed the center of the stroke, the steam admitted by the movement of the valve ring presses the piston up and throws up the bell. The tube connection allows the bell crank to move freely upward after the piston has reached the end of its stroke, cut off the steam, and open the exhaust port. The return swing of the bell is followed by the same action of the parts.

Improved Subsoil Plow.

Ira M. Griffin, Maryville, Mo.—This plow will open a wide double furrow The subsoil plow plate is secured to a standard, which is curved upward and forward, and its forward end is bolted to the upper part of another standard, several holes being formed in the latter standard to receive the said bolts, so that the pitch of the subsoil plow may be readily adjusted as may be required. The plow standard may be adjusted at discretion. The handles are attached to the double mold board.

Improved Belgian Zinc Furnace.

Theodore Hiertz, St. Louis, Mo.—The disadvantage of the high Belgian furnace consists in the fact that, in order to have heat enough for the reduction of the ores in the upper retorts, the lower ores were exposed to an excessive temperature, which caused the too rapid deterioration and destruction of the furnace lining and the retorts. The present invention is intended to obviate these defects, and consists in the arrangement of a series of flues in the front, rear, and side lining of the furnace for drawing in cold air near the lower part of the same, heating it up during the passage through the flues, and introducing it at about the middle of the hight of the furnace through small apertures in the lining to the interior, to mingle well and thoroughly consume the gases of combustion.

Improved Door Fastener.

James Black, East Pepperell, Mass.—This invention consists of a spring bolt with projecting roller end, which slides in a socket set into the door, and fastens the door by means of an angular plate with suitable inclines applied to the casing. A catch of the socket face plate projects into a recess of the spring bolt, and retains the same inside of the socket during the time the door is open.

Improved Rein Holder.

James Lowth, Chicago, Ill.—This is a movable spring clamping bar, pivoted and supported centrally, under which the reins may be respectively drawn in opposite directions. The construction is also such that the reins together may be drawn through or between bars and only toward the driver.

Improved Burial Case.

William S. Wood, Newtown, N. Y.—This invention relates to the construction of metallic burial cases, whereby the operation of putting the parts together is facilitated; and it consists in an eyelet or short tube inserted into the screw holes of the upper surrounding stay iron for holding the stay iron and the cover of the case together and the packing in position before the screws are inserted.

Improved Spring Bed Bottom.

Francis E. Lord and Herman K. Blanchard, Readsborough, Vt.—These wire springs have their median parts resting on slats and ends passed around under cross bars, then through the latter, and, finally, bent over, made parallel with and carried up through the slats.

Improved Treadle Motion.

Julien H. Thayer, Cold Hill, N. C.—The heel and the toe portion of the treadle are both pivoted to the axis, to be worked by rocking the foot. The heel part has an arm extending about as far as the toe piece, and having the usual connecting rod for turning the crank shaft connected to it, while the toe piece has a rigid arm rising up by the side of the connecting rod to its middle, and connected at its upper end to a connecting rod by a short connecting link. The upper end of the arm swings forward and backward across the connecting rod, and delivers the pressure of the foot on the toe piece against it transversely at the time it is passing its centers, thus carrying it past the centers.

Improved Device for Drilling Water Mains.

George B. Hand and John Carroll, Scranton, Pa.—A tubular piece has a screw-threaded socket at one end and a screw-threaded stem at the other. A screw cap is screwed to said stem, and the drill spindle passes axially through both the said socket piece and cap. There is a collar upon the drill spindle, against which the cap is made to bear to feed the spindle to its work, and also to prevent gas or water escaping around the drill.

Improved Boot and Shoe.

Michele Derosa, New York city.—The uppers of this boot or shoe, which is intended for summer wear, are of straw or analogous vegetable material, braided or plaited so as to assume the proper shape. The material is attached to a leather inner and outer sole, so as to form a durable connection

Improved Burglar Alarm.

Adolphus Reimers, Lowden, Iowa.—An arm is applied to a block, which is placed in such position that the slightest motion of the door or window may produce the dropping down of the block and, thereby, the release of the parts for giving the alarm, which are arranged at the front side of said block. They consist of a spring hammer, a projecting pin for setting the hammer end thereon, and one or more paper percussion caps, which are held by a band spring firmly on the block. The dropping of the device releases the hammer and discharges the percussion caps, the detonation of which gives the alarm.

Improved Fireproof Safe.

Edward H. Parker, Poughkeepsie, N. Y.—A top reservoir is called into action at a certain temperature, by fusible metal melting in a valve, so that water therein rushes through connecting Z tubes and valves into a main tank, and, after filling the latter, into the door tank. Inside valves allow the gradual escape of the steam formed in the tanks, but retain the water on whatever side the safe may be thrown. When the safe remains in its upright position, the steam of the main tank escapes through the top part of the vertical valves and the reservoir, that of the door tank through the tubes opening at the bottom of the door. If the safe falls in any direction, the reservoir is detached and the steam makes its exit directly through the entrance tubes. If the safe falls on its top, the steam escapes through the tubular stem of the vertical tank valves, while the water is prevented from escaping by the conical plugs being seated in the funnels of the casings; and generally, in whatever position the safe may fall, suitable arrangements admit of the escape of the steam while preventing that of the water.

Improved Tug Buckle and Hame Clamp.

James Wilcoxen, Morrisonville, Ill.—The clasp surrounds the hame, and takes the place of the old staple and hame hook. It is movable on the hame, up and down, so as to bring the draft at the proper point. A catch is secured to the joint pin, which closes into a recess in the clasp to secure and hold the same in the desired place on the hame. When the hame is on the collar, the catch is held in place by the latter. By this arrangement, the tug can be lengthened or shortened at the hame, and the point of draft can be brought to bear in the proper place on the collar or shoulders of the horse.

Improved Whip Tip Ferules.

Edward B. Light, Westfield, Mass., assignor to Edward B. Light & Co., same place.—This is a device for connecting a whip tip with the stock, consisting in a ferule having teeth formed in the sides thereof and adapted to be driven the whip tip and stock.

Improvement in Process and Apparatus for the Manufacture of White Lead.

Ludwig Brumlen, Hoboken, N. J.—This process of manufacturing white lead from metallic lead consists in moistening the material in a suitable revolving cylinder with a solution of acetate of lead, oxidising it by the introduction of heated air, combining the oxide with heated carbonic acid by the introduction of the same, and of removing and precipitating the white lead by a solution of acetate of lead and the uncombined carbonic acid from the cylinder.

Improved Machine for Cutting Roll Paper.

Ignatz Frank, New York city.—A ring-shaped cutter-carrying plate is rotated by a crank handle. Two cutting knives are pivoted at diametrically opposite points to the base plate and guide bands, which are attached by fastening screws to said plate, in such a manner that the cutting blades slide between them and the plate, being secured in open position sidewise of the central aperture by pivoted spring catches, which are forced with their hook ends through holes of the guide bands into holes of the knives. Strong spiral springs on the knives force the same toward the center of the aperture when released from the hook catches. Projecting handle ends of the knives serve to carry the same back into side position, to be held by the catches for adjusting the roll in the central aperture. The rotation of the cutter-carrying plate, in connection with the action of the springs on the knives, cuts the roll paper in rapid and even manner.

Improved Mold for Sugar.

A. H. William Schrader, Hoboken, N. J.—This mold has its top, body, and double bottom detachable, the inner bottom being perforated. An air passage is made through the center for the purpose of cooling the sugar during the process of crystalization.

Improved Corn Planter.

Lafayette E. Askew and William H. Sangster, Greenville, Ky.—In this planter, the seed-delivering devices are operated through the medium of a star or rimless wheel, which is turned by the advance of the machine. To the shaft, within the hopper, is attached a cross bar, the arms of which are cam-shaped. These agitate the seed in the hopper and enter alternately a slot in a plunger, so as to raise said plunger twice at each revolution of the wheel. The plunger, when released from the cams, is forced down by a bent spring. Plates are so formed that, when the plunger is raised, a cavity will be formed between them and the lower end of the plunger of such a size as to contain enough seed for a hill. As the plunger descends, its lower ends forces the plate apart, and allows the seed to drop to the ground.

Improved Running Gear for Wagons.

William L. Booth, Concord Station, Pa.—The rear bolster and the rear end of the reach are pivoted to the rear sand board and rear axle. The forward bolster and the forward end of the reach are pivoted to the forward sand board and the forward axle. The pivoted rear bolster is connected with the reach by two chains, so as to be always held at right angles with said reach. The rear hounds receive the rear ends of braces which pass beneath, and are secured to, the axle, and their forward ends are secured to the said hounds. The upper braces pass over the sand board and along the upper side of the hounds, to also serve as a facing for said hounds. The front fifth wheel frame is provided with a swiveled perforated ball, and the connection between the forward hounds and the axle is strengthened by brace straps.

Improved Double-Acting Pump.

James Robertson, New York city.—The tube with which the pipe is connected is separated from the lower valve chamber by a valve. From this tube a passage leads to the upper valve chamber, from which it is separated by a valve. From the lower valve chamber a passage leads into the lower part of the piston chamber, and from the upper valve chamber a passage leads into the upper part of the said piston chamber. The upper end of the lower valve chamber is closed from a valve, from which a passage leads to the head of the pump. The upper end of the upper valve chamber is closed by a plate, which is held down to its seat by a screw, which passes through a screw hole in the bar, the ends of which are placed beneath lugs cast upon the head. As the piston moves upward, a vacuum is formed in the lower valve chamber, which causes the water to pass up through the passage, raise the valve, pass into said chamber, and thence through another passage into the lower part of the piston chamber, to be forced out by the next downward movement of the piston. The same upward movement of the piston forces the water in the upper part of the piston chamber to raise the valve, pass into the head, and flow out through the spout.

Improved Bag Fastener.

Scott Wellington, East Saginaw, Mich.—A strap, the ends of which are attached to a plate, passes around the mouth of the bag. At points upon the strap are eyes through which a cord passes. Spring clutches attached to the plate receive the cord and hold it when the ends are drawn together. By compressing the springs, the cord is readily released.

Improved Paper Pulp Screen.

John S. Warren, Fishkill on the Hudson, N. Y.—The essential feature of this machine is a revolving cylinder, formed of segment plates of a larger circle than the completed cylinder, united at their edges and working in connection with the screen, which revolves in a contrary direction, thus producing a pulsating current, the whole operating in the vat.

Improved Bucket Ear.

Julius F. Vogt, St. Louis, Mo.—The ear is made with the ordinary bail eye, below which it is forked to straddle the stave, in which position it is fastened by a single rivet beneath the upper hoop. The ear is thus directly on the top of the bucket stave, and allows the bail to be connected in such a manner that the bucket dips, when lowered to the water, with greater facility than when attached by the ordinary ears.

Improved Fishing Tackle.

Henry L. Sprague, Tottenville, N. Y.—This invention consists of a spiral spring secured and contained in a hole passing through the sinker. The line is attached to each end of the spring, and the degree of expansion of the latter is limited by a cord. When the hook and line is set, the elasticity and yielding of the bait caused by the spring gives the fish courage to endeavor to obtain a better hold, and thus secures the hook, which leads to his own capture.

Improved Toy Attachment for Childrens' Carriages.

John D. McAnulty, Philadelphia, Pa.—This is a little contrivance whereby two dancing and one revolving figure may be operated for the amusement of children while riding in a child's carriage, the apparatus being attached to the front of the carriage and the mechanism geared with one of the wheels of the carriage by a belt.

Improved Cotton Bale Tie.

William H. Tillery, St. Helena Parish, La.—The band for baling the cotton is provided at both ends with side recesses, preferably alternating at the sides. These are inclined at one end, and curved in semicircular shape at the other end, in such manner that they form, with the edge of the band, hooks. The recessed band ends are slipped over each other, and tied by a link-shaped clasp, which is carried over in lateral position, and then diagonally into the connecting recesses, until two corresponding hooks catch at each side around the side pins of the clasp, cross over the same, and lock the band firmly thereto.

Improved Millstone Dress.

Madison Vandegrift, Cincinnati, O.—This invention consists in an improved millstone dress, formed of a circle furrow and two circles or sets of straight furrows, the inner or eye furrows being made with a greater draft or inclination than the outer or skirt furrows. This greatly facilitates the passage of the chaps from the eye to the skirt of the stone, and at the same time improves the ventilation.

Improved Paddle Wheel.

Henry Reynolds, Albany, N. Y.—This invention consists of two wheels made fast at a short distance apart on the same rotary shaft, having their respective sets of buckets arranged obliquely thereacross, and having the opposite points of corresponding buckets of the two wheels arranged above or below and at an obtu e angle to each other. It is claimed that by this construction the same amount of bucket space will be constantly submerged so that the action of the wheel will be uniform.

Improved Watch Case Back.

Henry Birna, Jersey City Hights, N. J.—A blank of the size and thickness required is punched out of any sheet metal commonly used for watch cases, and first struck up with an outer flange. The blank is then transferred into a die whose punch has a tapering rim, with a slightly-projecting central spring piston, which together form an angular recess with inclined side. The stroke of the punch on the flange of the blank carries the same to the inside, under the same inclination as that of its rim, and produces thereby a solid snap of triangular shape, which increases thickness toward the outer circumference of the cap or back, and strengthens the same at the point of greatest strain.

Improved Furnace for Burning Kilns.

George C. Surls, Rochester, Pa.—This invention relates to a heating furnace for brick, drain pipes, and earthenware kilns, in which an intense and regular degree of temperature is required for burning the wares, and in which the cheapest kind of fuel may be used. The furnace has double arches placed over the fire box, which form an air space, connecting with front air flues for heating up the air and conducting the same by rear flues to flues connecting the furnace with the kiln, so as to produce the intermixture and complete combustion of the fire gases on their entrance to the latter.

Machinery for Washing, Bleaching, and Dyeing Skins.

Thomas Golden, Cutchogue, N. Y.—This is a drum formed, as to its periphery, of bars, which are V-shaped on the inside to scrape the skins open the pores. The bars are attached at their ends to the heads of the drums. There are also similar V-shaped bars on the inside for scraping the skins. The drum has a door at the side for putting the skins into it and taking them out, and is provided with gear to swing it up out of the tank and over one edge of the latter to dump the skins out into a cart to save the labor of taking the skins out by hand. Pipes are attached to introduce steam and water to the bottom of the tank to regulate the temperature. The machine is to be used in the several processes of tanning and dressing such skins as calf, sheep, deer, goat, seal, and all kinds of light skins and hides, known as washing, liming, tanning, raising, aluming, and softening with water, lime liquor, or pure drench, tan liquor, alum, soft liquor or sumac, or any of the liquors used in tanning or dressing leather. It is also usefu for bleaching and dyeing of cloths.

Improved Portable Post for Tents, etc.

Henry D. Goldsmith, New York city.—The two parts of the post ar made tubular, and of such sizes that the upper part may be inverted and passed into the other part. Upon three sides of a short sleeve, into which the lower tube fits, are formed lugs to which are pivoted stakes, which are readily forced into the ground. Plates are provided which limit the depth to which the stakes can enter the ground, and at the same time adjust themselves to any unevenness of the surface. At the upper end of the highest tube is a cap having a hinged clamp and plate for holding the horizontal rod which supports the tent.

Improved Sheathing for Buildings.

Rowell Colby, Freeport, Ill.—This invention consists in a fireproof roofing or sheathing for buildings, which is formed of metallic or paper sheets and a filling of mortar. The sheathing is placed along the lowermost part of the surface, and a cleat is tacked along the upper edge. A coat of mortar is then applied, so as to fill up the space above the cleat. The sheathing is next folded over cleat nails and mortar, and another strip is placed along the upper edge, and fastened in a similar manner by a cleat and nails along and with the edge of the lower strip. This operation is continued until the whole surface is neatly finished, the upper course being fastened by a cleat or strip of the paper or other material nailed over the same.

Improved Watchman's Time Check.

Carl Pfisterer, Ebingen on the Danube, assignor to Theodore Hahn, Stuttgardt, Germany.—This control apparatus is set by placing a pointer indicating the number of stations against a starting figure on the dial. Another pointer showing the number of rounds is also set against the highest figure on the dial. The several keys are secured in the places or stations to be visited by the watchman, who carries the clock with him, introducing each key in the regular order into the case till all stations have been visited. The rounds will be indicated on the second dial as each trip is completed. Should any station be omitted, the next key will not work the instrument, and will compel, therefore, the watchman to return to that station for bringing the time check in regular motion.

Improved Tool Handle.

George Carlisle, Attleborough, Mass.—A tip, made of horn or similar hard material, is attached to the handle, and has a broad shoulder and a centra tenon, the tenon being of less diameter at the shoulder than at its end, and tapering or curved from the end to the shoulder. The hole in the handle is made of the size of the end of the tenon. A ring of steel, with its ends of equal diameter outside, but with the inside to correspond with the shape of the tenon, is inserted in the handle outside of the tenon mortise, so that, as the tip is forced down, the wedge section of the ring causes the wood about said mortise to hold the tenon tightly.

Improved Hydrant Cover.

James McKnight, Brooklyn, N. Y.—Spring catches are provided on the cover extending down in the hydrant, and are held out in notches in the latter by a cam suspended on a spindle projecting from the under side of the cover. The upper end of the spindle terminates in a socket on top of the cover, and is turned by a wrench. The cam is held in position for keeping the catches in the notches by friction.

Improved Earth Auger.

Washington Smith Jones, Meridian, Miss.—A lower borer plate is formed of two symmetrical halves of cast iron connected around the recessed part of the shaft by means of semicircular collar extensions which embrace the shaft, and are firmly attached thereto by a sleeve. The sleeve is slipped over the collars and keyed to the shaft by a cross pin. A second screw plate is attached to the shaft, at a suitable distance above the end plate being also made of symmetrical halves, and which serves mainly to take off the weight of the earth from the lower plate, and lift a greater quantity on hoisting the auger. The detachable guide drum or band is also produced of two equal parts, constructed of V-shaped plates with collar extensions, and applied consecutively to the various recessed parts of the shaft above the plates by a sleeve and cross pin. Strong radial arms are applied to each plate, and a semicircular band, having the same radius as that of the lower plates, is suitably and firmly connected to their ends. The ends of one half drum are provided with stationary sleeves, into which projecting parts of the ends of the corresponding half drum fit, producing thereby on the attaching of both parts a full drum for guiding the auger in the required straight direction. The guide drum is transferred with the increasing depth of the borer plates to the upper part of the shaft, and the straight direction of the auger easily controlled.

Improved Well Auger.

Robert J. Gardner, Carlisle, Ark.—This invention consists in combining, with a shaft having a radially slotted bottom and edge-turned knives, a sliding top-closed cylinder and fast ring, whereby an earth auger is formed whose cutters take off successive shavings or thin slices of soil which are rapidly transferred into the cylinder. The latter continues to rise on the shaft until it strikes the fixed ring, when the auger is withdrawn and emptied of its contents. By this peculiar construction and combination of parts, the auger is enabled to do its work with singular neatness, efficiency, and economy of labor.

Improved Wood Bending Machine.

Augustus F. Marshall, Black River, N. Y.—This is a machine for bending wood for chair backs and the like by the use of a movable crosshead and screw for working it. It is an improvement on the patent granted to same inventor September 5, 1871. It consists in the combination of two screws with the crosshead for working it, in a manner calculated to avoid the cramping and binding of it with the ways. The screws are geared with a countershaft, and are both turned alike, so that one will not overrun the other. The invention also consists of such arrangement of the stirrups the former, its carrier, and the die in which the back is bent, that the arms are bent while the former is being moved out of the die for bending the back to adjust it for receiving the next bar.

Answers to Correspondents

G. W. P.'s description of the double star is too vague to allow us to recognize it.—C. J. K. will find descriptions of some breech-loading cannon on pp. 149, 402, vol. 27.—A. H. will find a recipe for silver-plating solution on p. 170, vol. 30.—W. H. B. will find directions for transferring pictures to glass on p. 43, vol. 30.—J. H. M. will find a recipe for quick-setting glue on p. 33, vol. 31, and for a cement for wood and glass on p. 274, vol. 30.—J. T. will find directions for galvanizing cast iron on p. 59, vol. 24.—C. H. S. will find directions for keeping eggs on p. 378, vol. 30.—T. C. W. will find a recipe for waterproof paper on p. 346, vol. 30.—D. G. & S. are referred to p. 107, vol. 29, for directions for annealing steel.—We do not understand what J. A. F. means by a vacuum cylinder to a steam engine.

(1) C. S. asks: Please tell me how I can photograph on tin. A. The process is the same as that of preparing glass negative plates; the difference is due to the dark background, which reverses the shades and thus renders the picture positive.

How is lithographing done? A. The stone used in lithography is a limestone (carbonate of lime) of a very hard and compact texture, admitting of being ground to a fine surface. The stone must have the qualities of imbibing both water and grease or oil, the crayon used in drawing upon it being composed of grease, wax, soap, shellac, and ivory black, which is also the composition of the ink used in printing, with little variation. The stone, having the picture drawn upon its smooth surface with the prepared crayon, is wet with water. While the stone is still wet, an inking roller is passed over its surface. While the wet part of the stone refuses to take the ink, the crayon lines, being of a greasy nature, will take a portion of it from the roller. The stone is then ready for printing.

1. How can I make albumenized paper, and how sensitize it? A. Ammonium chloride 200 grains, water 5 ozs., albumen 15 ozs. The mixture should be well beaten, and the froth that forms skimmed off and placed in a flat vessel to subside. To sensitize the prepared paper, coat one side evenly with a solution of 60 grains of nitrate of silver in 1 oz. of distilled water. This latter operation must be performed in a dark room, or by candle light. 2. With what do photographers fix pictures taken on glass with collodion, before transferring to the paper? Do they remove the collodion that is not acted upon? A. Either solution of hyposulphite of soda or cyanide of potassium. The picture should first be developed by pouring over it a solution of sulphate of iron in water. 3. Does iodine come in a liquid or solid form? A. Solid.

(2) W. C. asks: 1. Will thin sheet lead resist the action of sulphuric acid for an unlimited period, at ordinary temperature, so as to be a safe receptacle? A. It is so used in the lead chambers of a sulphuric acid manufactory. 2. Will it in the same way resist nitric acid? A. No. 3. Can it also be used to contain muriatic acid? A. No.

(3) J. A. H. says: I have read your abstract from Mr. Chase's article on "Fishing by means of Explosives." 1. Will common gunpowder, gun cotton, or dynamite do for such a purpose? A. Yes. The quantity used depends much upon the depth of water. 2. Should the cartridge wrapper be thick metal or will varnished paper do? A. Paper will answer the purpose.

(4) P. M. asks: How can I transfer ordinary engravings to glass? A. Fix the printed surface to the glass with ordinary paste. Etch with liquid hydrofluoric acid of specific gravity 1·14. At the end of 3 or 4 minutes wash off the paper, and the design will be found reproduced upon the glass.

(5) J. S. says: You say that the point of a wagon wheel touching the ground comes to perfect rest, the wheel being in motion. Do you claim that one part of the wheel is going fast, another slow, and another standing still? If so, is it the same with friction pulleys and idle wheels? Can one part of a solid wheel stand still and another part be in motion? A. Each point as it reaches ground is at rest with respect to any fixed point in the earth, but has the same rate of angular motion as the other points in the circumference.

(6) O. M. R. says: I am making hydrogen from sulphuric acid and zinc in a cylinder for oxyhydrogen light. The cylinder is coated with vulcanized rubber. Why cannot I use (in place of the zinc) iron turnings? A. You can use iron. But iron in dissolving in dilute sulphuric acid does so with the formation of froth, and the evolution of certain oily hydrocarbons. The solution, moreover, soon becomes saturated with ferrous sulphate, which soon crystallizes. You will have trouble and will find that it is less satisfactory, except in the matter of cost, than zinc. 2. What quantity of acid will it require to consume 1 lb. of iron, and what volume of gas will be produced? A. It will take 28 ozs. strong oil of vitriol, and 5 cubic feet and 1640 cubic inches of gas will be evolved.

(7) J. C. P. asks: How can I temper No. 16 brass wire, so as to make spiral springs? I have tried hammering and heating, and failed every time. A. There is a brass wire, already tempered, made specially for springs.

(8) B. O. says: I wish to solder a piece of metal about an inch square, to the side of an iron kettle; it is to be a sort of bed piece to which a hasp is to be attached, capable of sustaining a weight of 15 or 20 lbs. Is there means by which I can make this attachment? A. Braze it by the ordinary method, using spelter and borax.

Is there any machine for bending or twisting wire, by which I can manufacture wire loops to be soldered to tin vessels? A. Use a solid block of iron, in which put three pegs in the required position, and bend the wire, by hand, alternately round the pegs to form the desired loop.

(9) L. M. S. asks: 1. Can water be electrified so as to be sparkling? A. No. 2. Will electricity settle muddy or sooty water? A. No. 3. Would electricity aid in bringing butter quickly in churning? A. No. 4. Would air, forced or pumped into an ice cream freezer while freezing, make ice cream lighter or smoother? A. No.

(10) J. B. asks: 1. Is it possible to cast brass in cast iron or wrought iron molds without heating the latter before the process of casting? I want to obtain a smooth underside of the casting, to render filing and planing unnecessary. A. There are facing sands and compositions for molding smooth castings which answer for the purpose you mention better than any other device. 2. Would plumbago be a non-conductor good enough to prevent explosion if rubbed on the inner sides of the mold, or would a mold, made of plastic graphite, render a very smooth casting without wearing out fast? A. Yes.

(11) P. S. V. asks: Will sulphur water when used in a steam boiler cause a scale of sulphur inside? A. It would not be advisable to use this kind of water. Possibly the sulphur could be removed by some of the feed water heaters in the market.

(12) A. H. asks: Are brass tubes drawn or rolled in grooved rolls? A. They are drawn. 2. Could tubes be rolled by inserting a steel rod (inside of tube) in grooved rolls, the grooves being graduated like holes in a wire draw plate? A. The plan you mention is practicable, and is, we think, in use.

(13) A. McG. asks: How can I clean an oil painting that is injured by dust and particles of wrapping paper? A. We can recommend the following: Take the picture out of frame, lay a coarse towel over it for 10 or 14 days; keep it continually wet until it has drawn out all the filthiness from the picture; pass some linseed oil which has been a long time seasoning over it, in the sunlight, to purify it, and the picture will become as lively on the surface as new.

What is best for cleansing and burnishing church plate? A. Try the following recipe: Plunge the article into this solution: Hyposulphite of soda 1 lb., sal ammoniac 8 ozs., solution of ammonia 4 ozs., cyanide of potassium 4 ozs. Let it remain one half hour, wash, and rub with buckskin. The cyanide of potassium is very poisonous. It may be omitted, but then the solution is not so active. No powder is necessary in polishing.

(14) C. S. J. asks: What is a test for arsenic in wall paper? A. Marsh's test is the simplest. Put several small pieces of the suspected paper, with water, in a flask containing small pieces of metallic zinc; make the liquid acid by sulphuric acid. This immediately attacks the zinc, generating hydrogen. Through the cork in the top of the flask, pass a glass tube, drawn to a fine point at the outer end. After the hydrogen has been evolved for a short time, ignite it at the outer end of the glass tube; bring a polished surface of porcelain in contact with the flame of hydrogen, if there be any arsenic present, it will be combined with the hydrogen, and the flame will color the porcelain with the black arsenical mirror.

(15) J. R. M. says: A shopmate says he can make a single tap that will cut 4 different threads, 8, 16, 24, and 32. How is it done? A. A tap cannot be made to cut different threads unless it has removable teeth. It may be used as a tool in the lathe, and thus cut a double or triple thread; but this would only be a curiosity, as a tap used as a tool chaser would be a most unmechanical device. An ordinary tap, used as a tap, will only cut a thread of one definite number to the inch.

(16) O. P. asks: 1. How can I find, on the surface of a revolving cutting iron, the exact shape for striking any given molding? A. Your best plan will be to mark out with compasses, squares, etc., on a piece of sheet tin, the molding required; then cut out the same and use it as a gage. You can make a male and female gage from the sheet tin. 2. If a cutter make a given pattern of molding when revolving on a cutter head 6 inches in diameter, would not the same cutter, if used on a cutter head 6 feet in diameter, produce molding of a different form? A. No.

(17) J. H. L. M. asks: Has a vacuum ever been produced in a steam engine without using the exhaust steam? A. Not to our knowledge.

(18) A. H. asks: How can I prepare the glasses for a camera? A. To make small lenses, prepare a vertical crank arbor with a screw thread for chucks cut on the top, to be worked by a treadle. The frame supports a tub of wet sand through which the arbor rises. Lead-faced chucks are cast of proper curvature, and the lens is held upon the chuck by a wooden handle attached with pitch, while sand and water are applied. Convex lenses may be cemented to the chuck by drops of pitch half an inch apart. When rough ground, they may be finished with a brass or iron grinder, worked with emery alternately on the lens and on another grinder which fits it. Finally apply rouge with pitch polisher, as we have before directed. Flint glass disks may be cemented to a chuck and turned in a lathe with the end of a three cornered file ground to 60°, dipped in water acidulated with sulphuric acid, until the glass touches a brass tool all over. It may then be ground, stuck to a handle with sealing wax, and polished with rouge against a sealing wax polisher revolving in the lathe. The wax is removed with alcohol. For flat surfaces, as of prisms, three brass chucks must be continually worked upon each other while the surface is ground upon one of them. For photographic cameras, any glass will do, as some diffusion of focus is requisite. For telescopes and microscopes, it must be faultless. To photograph at the visual focus of a telescope the object glass lenses may be separated one thirtieth of the focal length; or better, the plateholder may be racked in a marked distance found by trial, or a view tube lens may be placed outside the focus. To photograph the moon, planets, and stars, a nitrate of silver bath, 35 grains to the ounce of water, must be used with a collodion containing iodide of cadmium. For the sun and portraiture, a bromized collodion may be used with a 90 grain silver bath. The plate is dipped into a weaker bath before exposure. The dark room shoul be well lighted through buff-colored envelope paper. For stars, the plate is lighted a moment by an argand burner 8 feet off, before exposure.

(19) M. W. asks: 1. How is printer's poster ink made? A. A good common ink for this purpose may be made as follows: Take 16 ozs. varnish, 4 ozs. linseed oil well boiled, 4 ozs. clear oil of turpentine, 16 ozs. fine lampblack, 2 ozs. fine Prussian blue, 1 oz. fine indigo. Boil one hour. 2. Are there machines for printing entire flags at one impression? A. Small machines for this purpose are, we believe, in use in this city.

(20) M. H. P. asks: Would it be practicable to draw water a distance of 160 feet length and 18 feet fall, with a suction pump and cement pipe? A. It can be done with a good pump and well laid pipe.

Is a brass kettle injurious for cooking fruit preserves, etc.? A. Not if it is clean and bright at the time of use.

In what way can light cassimere pants be washed? A. Dissolve a little curd soap in water, and mix a little clarified ox gall with it. Rub the mixture on all the spots of grease and dirt, and rub it in with a stiff brush; then brush the garment, and sponge with the same mixture well diluted with warm water. Rinse in clean water, and hang up to dry.

(21) P. M. K. says: 1. An engine has a 12 inch cylinder x 24 inches stroke, and runs at 75 revolutions. It is filled with two main slide valves; and a cut-off slide valve works on back of main valve, cutting off at $\frac{1}{2}$ stroke. The travel of the main valve is $2\frac{1}{2}$ inches. No. 1 valve has $\frac{1}{8}$ inch lead on steam and $\frac{1}{8}$ inch lead on exhaust, with $\frac{1}{8}$ inch lap on steam and no lap on exhaust end. No. 2 has no lead on steam and $\frac{1}{8}$ inch lead on exhaust, with $\frac{3}{8}$ inch lap on steam and $\frac{1}{8}$ inch negative lap on exhaust, or both exhaust ports are open $\frac{1}{8}$ inch when the valve is on the mid stroke. Which of the two valves is the best, all other conditions being the same? A. The first. 2. An engine is fitted with ordinary double slide valve (no cut-off attached) which has equal lead; but it will not cut off equally, following $1\frac{1}{2}$ inches further on the out stroke than on the in. How is this? A. It is on account of the angularity of the connecting rod.

(22) N. O. A. asks: 1. Does it preserve a tooth permanently to have it filled, provided it is done well? A. Yes. 2. Is silver as good as gold for filling in every respect? A. No.

(23) M. H. B. asks: What is the best plan of setting up the follower rest, to an engine lathe, for the purpose of turning slender iron rods, of different size? Will one guard do, or will it take a different one for every sized rod? I tried a forked guard, but for some reason it did not work satisfactorily. A. A common plan is to have a plate composed of two forks, which can be adjusted for different sized rods. This holds the work in all directions, the effect of moving the adjusting screws being to make the square opening between the forks larger or smaller.

(24) M. asks: 1. How do you find the mean effective pressure per square inch on the piston of a steam engine? A. From an indicator diagram. 2. What is the most economical speed for a piston? A. This depends on a variety of circumstances, and would require more space for the discussion than we can give in these columns. 3. What book will give me the formulæ for the proportion of the parts of a high pressure engine? A. We can recommend Van Buren's work on "The Strength of Iron Parts of Steam Machinery."

What is the reason that, on taking a kettle of boiling water off the stove, one can bear his hand on the bottom for a short time, but after that the heat becomes unbearable? A. On account of the protection afforded by the soot.

Can an imponderable agent have any momentum? A. Yes.

(25) W. T. E. S. asks: How long would a reservoir containing 1,388 cubic feet, filled with air compressed to 300 lbs. to the square inch, last 8 men, who are in an airtight room containing 240 cubic feet of air, supposing that the compressed air is let in as required, and the foul air let out? A. From 4 to 5 hours. We do not think that your plan for a torpedo boat is novel.

(26) C. S. asks: What is the action of steam? I was before an examining board, and that question was put to me and others. A. It is rather difficult to answer a question of this general nature, but the action of steam may be compared to that of a compressed spring.

(27) R. I. asks: What would the pressure of air be to the square inch in forcing 2,500 cubic feet per minute through eight round openings, 4 of 1 inch and 4 of $1\frac{1}{2}$ inches diameter? A. You will find rules in Weisbach's "Mechanics," by which you can make the calculations.

(28) W. S. B. asks: How far will a person have to stand from the roots of a tree 100 feet high that the top may be just visible, the earth being level with the exception of its natural curve? A. About 13 miles.

(29) E. P. R. & Co. ask: Would it be practicable to take steam from a boiler 550 feet distant to run a 10 horse engine, the boilers (of course doing other work) being of 100 horse power? A. The plan is perfectly practicable, and often adopted. If the pipe is properly protected and trapped, the loss will be trifling.

(30) L. G. D. says: I wish to draw strips of common steel one fourth of an inch thick and four inches wide to a tolerable cutting edge. This is done by hammering when hot and drawing to an edge. Would it be possible to do it by passing the steel between two steel rollers, made tapering so as to draw the steel plate to an edge? Could one man thus sharpen a strip of steel by turning a crank connected with one of the rollers? Can common soft steel ¼ inch thick be brought to an edge in this way when cold? A. We do not think you could get a very good edge in this way; and if the machine were worked by one man, the operation would be very slow.

(31) J. H. says, in commenting on our answer to A. B. & C., who asked if water can be raised by a siphon above 34 feet: You answer "No." I differ in opinion from the above answer. I say that the atmospheric pressure has nothing to do with the movement of the water through the siphon, the pressure being the same at either end; and I am fully satisfied that, if the long leg of the siphon contains sufficient weight or volume more than the short leg, water can be raised to any required hight. A. Your theory would answer very well if the column of water were connected together after the manner of a rope; as it is, we prefer to hold to the original explanation. Should you doubt it, however, you can readily make the experiment.

(32) U. Z. L. asks: What is the best method of removing rust from iron and steel? A. Use an emery block, with oil; such blocks are supplied by the makers of emery wheels.

(33) A. Z. L. says: 1. I am building a steamboat 37 feet long, with 6 feet beam and about 33 or 33 inches draft. Are these last dimensions in proportion to the length? A. They will answer very well. 2. I have a four horse power boiler and 2 one horse power engines which I propose to connect to a propeller shaft. What should be the size and pitch of the propeller? A. Try 30 inches diameter, 3½ feet pitch. 3. At what rate would the above engine propel the boat? A. 5 or 6 miles an hour. 4. Can I attain a speed of 18 knots an hour with a boat of the above dimensions? A. So small a boat could hardly carry the machinery for such a speed.

(34) W. H. B. asks: Can a barrel that has had vinegar in it be cleaned for keeping beef in? A. Yes, by using a strong potassa lye, and then thoroughly cleansing with water.

(35) N. S. asks: 1. How can I make a good silver-plating fluid? A. Dissolve 1 oz. nitrate of silver in 3 pints distilled water. Add strong solution of cyanide of potassium until no further precipitation takes place. If too much cyanide is added, it will redissolve the precipitate. Pour off the supernatant liquid, and wash the precipitate carefully. Now add strong solution of cyanide to dissolve the precipitate. Make one gallon with distilled water. The solution should have a moderate excess of cyanide, and it must be filtered before using. 2. What is a good simple way of plating with a battery? A. See pp. 75 and 183, vol. 30.

(36) C. says: In No. 9, current volume, you give the specific heat of carbonic acid as 0·21630, water being unity. What is the specific heat of carbonic acid gas? If one pound of this gas were placed in a tight tin vessel at a temperature of 120° Fah., immersed in another vessel containing one pound of water at 70° Fah., and allowed to remain until cooled by the water, at what degree would the two temperatures meet, no allowance being made for loss of heat? A. The number given is the specific heat of the gas. Let x=number of degrees which the 1 lb. of carbonic acid gas must lose: then $120°-x=70°+0{\cdot}216x$. $1{\cdot}216x=50$, or $x=41{\cdot}12$. And $120°-x=78{\cdot}88°$, $70°+0{\cdot}216x=78{\cdot}88°$, which is the point at which the temperatures would meet.

(37) A. D. B. asks: How can I prepare chemical paper for telegraphic purposes? A. We believe the fluid used is a solution of ferrocyanide of potassium. 2. Can the solution be used as a writing fluid, with a pen, so that the paper would only be sensitive where covered with the writing? A. It may be used with a pen, but not a steel pen. 3. Where paper is a nonconductor, does the solution render it a conductor? A. Yes.

(38) A. H. Y. asks: 1. What property is there in some well water which destroys the lead pipe of a pump? A. Lead is corroded by pure water when it is exposed to the united action of the air and water. The water dissolves the oxide of lead. In case the water contains certain mineral matters in solution, its corrosive action on the lead is increased; other mineral salts diminish its corrosive action. A chemical analysis of the waters of your well would show exactly to what ingredient this corrosive action upon the lead was due. 2. Why does a lead pipe in a manure vault crumble to pieces? A. The manure in decomposing forms nitrates, nitrites, and certain ammoniacal salts, all of which exert a corrosive action upon the lead. 3. I often find that some water will act very quickly upon block tin pipe, filling it with little holes from which a fine dust is procured. What is the cause of this, and what is the dust? A. The white body is an oxide or other compound of tin, resulting from the causes above described. 4. Is block tin pipe poisonous to water, like lead? A. No.

(39) F. O. asks: How can I dye feathers to a red color which will be waterproof, to be used on fish hooks? A. Take 1 oz. Brasil wood in powder, ½ oz. alum, ½ oz. vermilion, and 1 pint of vinegar; boil them up to a moderate thickness, and dip the feathers (they having been previously steeped in hot water) into the said mixture. As to your other question, address Seth Green, Esq., Rochester, N. Y.

(40) C. S. T. asks: Is oleomargarin the proper name for butter manufactured from beef suet? A. It is a proper name, being derived from two of its principal constituents. 2. Is there any difference between the oil of beef suet (when it is separated from the stearin) and butter oil? A. If we clearly understand your meaning, the olein is the same in both substances. The olein found in butter was considered by Bromeis to be of a peculiar kind, which he termed butyrolein; but Gottlieb has shown that the difference in properties between the oleic acid obtained by Bromeis from butter and that obtained from ordinary olein depended simply upon the oxidation which it had undergone during the process adopted in preparing it.

(41) J. L. asks: How can I make an æolian harp? A. See p. 330, vol. 26. The strings should be drawn tight.

(42) T. G. G. asks: What are the characteristics of asbestos or amianthus? A. Asbestos is a variety of hornblende or amphibole, which is a silicate and aluminate of magnesia, lime, and protoxide of iron, with a variable proportion of fluorides of calcium and potassium. It is soluble in a mixture of certain proportions of hydrofluoric and sulphuric acids.

(43) N. N. B. asks: At what parallel of longitude does each day begin and close? A. At 180° east or west of Greenwich.

(44) R. C. D. and others ask: Is there any way of bleaching beeswax without going through the long and tedious process of sun bleaching? A. It may be done by means of nitric acid; but chlorine, though it destroys the color, cannot be employed for this purpose with advantage, for it was observed by Gay Lussac that a substitution of chlorine for a portion of the hydrogen occurs under these circumstances. When candles made from such wax are burned, irritating vapors of hydrochloric acid are evolved.

(45) A. D. L. asks: To find the coefficient of friction in a moving body, do you divide the weight required to move the body by the weight of the body? A. Yes. As to your pendulum query, consult a work on analytical mechanics.

(46) J. K. B. asks: 1. What is the most accurate method of finding the throw of the eccentric for any travel of valve? A. The throw of eccentric must be the width of the steam port added to the amount of lap on the valve; hence the travel of the valve or (what is the same thing) the stroke of the eccentric must be twice the width of the steam port added to twice the amount of lap on one side. 2. What is the most accurate method of proportioning slide valves for any width of ports? A. A slide valve should always have at least ¼ inch lap, so as to give a free exhaust, the width of the exhaust port of the valve being 1-16 or 1-32 less than the width between the steam ports of the cylinder face. Additional lap must be added if working expansively is desired. 3. What is the most accurate rule for calculating the pressure on slide valves? A. If the faces of the valve and seat are fitted steamtight, the entire pressure will be the product of the entire area of bearing surface and ports in inches multiplied into the pressure per square inch maintained in the steam chest. This, multiplied into the coefficient of friction between the two surfaces, will give the force required to move the valve under such pressure when unbalanced. But as there are few valves which remain accurately fitted, any method of balancing slide valves should provide for experimental adjustment.

(47) C. M. A. says: I am about to build a small cottage building, which I wish to construct as economically as possible, and at the same time to introduce some modern conveniences. Among other things I propose to place my cistern on the second floor, so as to take the water over the house. Now a cistern of the requisite capacity, say 75 barrels, if lined with sheet lead or similar material, would be quite expensive. I propose to make a rectangular box of plank, of the requisite dimensions, to lath it inside across the grain of the plank, and then to apply a good coat of water lime cement. The cistern is to be located over an unfinished room, so that in case of possible slight leakage no harm would be done before the leak could be stopped. To guard against freezing, I will put at least 1 foot of dry sawdust over the whole thing. Can this be done effectively? A. We have no confidence in the kind of tank that you propose; the swelling and shrinking of the plank would cause the cement to crack. A better plan would be to construct a circular tank of 2 inch plank in staves, largest at bottom, and secured with strong iron hoops that may be driven down upon it if the wood shrinks. A tank like this can be made tight without a lead lining. If your house is tight, the water will not freeze more than ¼ inch thick on the top, and you will not require any special protection for this.

My rooms will most of them be as small as to make stoves inconvenient. I propose, in place of a furnace, to place one of the largest sized cast and sheet iron cylindrical stoves in the cellar, and to enclose this with a brick wall distant 1 foot all around, and make connection with this space by pipes to the open air on one hand, and to the rooms above on the other. The space to be heated will be about 14,500 cubic feet. What is your opinion as to the practicability of this? A. Your stove enclosed in brick is a proper heating furnace, but the number of cubic feet of air heated will be in proportion to the number of square feet of heating surface provided, and the latter may be increased in your case by introducing, by means of elbows, two or three joints of smoke pipe within the air chamber.

(48) C. G. asks: Cannot the poke root plant, which grows in such great profusion throughout the South and West, be made to subserve some useful purpose, rather than be treated as a troublesome weed? As all know who are acquainted with it, the berries have an abundance of juice of a beautiful deep red color and thousands of gallons could be obtained annually It makes a beautiful ink, but it fades after a little time. I have tried putting in copperas, alum, etc., but they only precipitate the coloring matter. How can this beautiful color be utilized? A. The poke root (*phytolacca decandra*) is an indigenous plant, with a very large perennial root, and is used in medicine. "The root abounds most in the active principles of the plant. It should be dug up late in November, cut into thin transverse slices, and dried with a moderate heat. As its virtues are diminished by keeping, a new supply should be obtained every year. The berries should be collected when perfectly ripe, and the leaves about the middle of summer, when the foot stalks begin to redden. The berries contain a succulent pulp, and yield upon pressure a large quantity of fine purplish red juice. They have a sweetish, nauseous, slightly acid taste, with little odor. The coloring principle of their juice is evanescent, and cannot be applied to useful purposes in dyeing, from the difficulty of fixing it. Alkalies render it yellow; but the original color is restored by acids. The juice contains saccharine matter, and after fermenting yields alcohol by distillation. The dried root is of a light yellowish-brown color externally, very much wrinkled, and, when in transverse slices, exhibits on the cut surface numerous concentric rings, formed from the projecting ends of fiber, between which the intervening matter has shrunk in the drying process. There is no smell; the taste is slightly sweetish, and at first mild, but followed by a sense of acrimony. The active matter is imparted to boiling water and alcohol. From the analysis of Mr. Edward Donelly, the root appears to contain tannic acid, starch, gum, sugar, resin, fixed oil, and lignin, besides various inorganic principles. It is emetic, purgative, and somewhat narcotic. As an emetic it is very slow in its operation, frequently not beginning to vomit in less than one or two hours after it has been taken, and then continuing to act for a long time upon both stomach and bowels. The vomiting produced by it is said not to be attended with much pain or spasm, but narcotic effects have been observed by some physicians, such as drowsiness, vertigo, and dimness of vision. In overdoses it produces excessive vomiting and purging, attended with great prostration of strength, and sometimes with convulsions. It has been proposed as a substitute for ipecacuanha, but the slowness and long continuance of its action wholly unfit it for the purposes which that emetic is calculated to fulfil. In small doses it acts as an alterative, and has been highly recommended in the treatment of chronic rheumatism. The dose of the powdered root, as an emetic, is from 10 to 30 grains; as an alterative, from 1 to 5 grains. A saturated tincture of the berries prepared with diluted alcohol may be given in rheumatic cases, in the dose of a fluid drachm three times a day. An ointment, prepared by mixing a drachm of the powdered root or leaves with an ounce of lard, has been used to advantage in *psoratinea capitis* and some other forms of cutaneous disease. It occasions at first a sense of heat and smarting in the part to which it is applied. An extract made by evaporating the expressed juice of the recent leaves has been used for the same purposes, and acquired at one time considerable repute as a remedy in cancer."—*U. S. Dispensatory*.

(49) O. C. asks: Is there any waterproof varnish by which paper can be fastened to glass so as to let gaslight penetrate through and show printed figures on the paper? A. Ordinary dammar varnish will doubtless answer your purpose.

(50) W. H. S. asks: How can I make muriatic salts of nickel? How can I make the solution of the salt? A. Chloride or muriate of nickel is formed by dissolving the oxide of nickel in hydrochloric (muriatic) acid. On evaporation it yields green hydrated crystals; by heat it may be obtained as a yellowish-brown anhydrous mass. It is soluble in distilled water.

(51) X. U. S. asks: How can I dissolve glass, and harden it? A. Ordinary glass is converted into a semi-fluid mass at high temperature. When heated with a quantity of carbonate of soda or potassa, it is converted into a soluble form, known as water glass. It cannot be re-hardened in the way you desire. We do not understand your other question.

(52) E. R. M. & P. W. ask: Is there any compound or solution (except iron or steel) that will act as an insulator between a permanent magnet and a piece of iron or steel? A. A short interval of space.

(53) G. A. M. says: A thermometer was sent to me a long distance by rail, and I find that the mercury in the tube is separated into three portions. I think air is in the tube. Please tell me how to get the mercury together. A. If you cannot do it by shaking or jarring the mercury together, open the upper end of the tube, form around the opening a small funnel with clean wax or paraffin. Gently heat the bulb with a spirit lamp, which will force a portion of the air out of the tube, then allow the tube to cool; repeat the operation several times, or until the mercury is together. The mercury is then heated to boiling, the vapor of which soon expels the remaining air and moisture. The tube, being now full of expanded mercury and mercurial vapor, should be hermetically sealed.

(54) W. W. asks: Can common family soap do any harm in the cylinder of an engine? Being out of grease some time ago, I used some chunks of common soap as a lubricator. I found it much superior to any grease I have used; but I am told by some that it leaves a residue behind, and blocks up the cylinder passages, etc. A. We cannot recommend the use of soap for this purpose.

Where can I get tables of the decimals of an inch, or how can I reckon them? A. Decimals decrease by tens; common fractions are expressed in decimals as follows: thus $\frac{1}{2}=0{\cdot}5$; $\frac{1}{4}=0{\cdot}25$; $\frac{1}{8}=0{\cdot}125$; $\frac{1}{12}=0{\cdot}0833$; $\frac{1}{16}=0{\cdot}0625$; $\frac{1}{32}=0{\cdot}03125$, etc. To reduce decimals to common fractions, use the figures as a numerator, and put 1 for the decimal point and as many ciphers as there are figures for the denominator. Thus $0{\cdot}25=\frac{25}{100}$, $0{\cdot}03125=\frac{3125}{100000}$, etc.

(55) M. S. P. C. says: In shops where they cut glass there is a powder used for polishing, made by burning tin until it is nothing but dross. This dross is heavier than the tin was originally. If you take 120 lbs. of tin, it will weigh (after burning) 126 lbs. How do you account for it? A. In burning, the tin is converted into the oxide, or, in other words, it absorbs a certain amount of oxygen from the air. The same is true with all metals when burned in contact with the air.

(56) J. W. P. asks: 1. About how long a time will 3 Leclanché cells last on an open circuit of 70 feet, where the circuit is closed only a second at a time 15 or 20 times a day? It is used to ring a tapping bell. A. From 6 to 12 months. These cells are in use in our office, and work six or seven bells or sounders. The cells have not been touched, we believe, for ten months past. 2. About how long a time will a Leclanché cell last on a closed circuit? A. This depends a great deal upon the resistance of the line and the sounders, etc. 3. Is there any loss of electricity at the press knobs where the metal touches the wood, or at any other place where the wire may happen to touch wood only? A. The loss would be imperceptible on a short line. 4. If two cells can do the required work, will the battery last a longer time if I use three cells? A. No. 5. For telegraph wire, will lead water pipes, running into a well, make a good ground circuit? A. No.

(57) W. H. D. asks: How can I make copper gas cylinders for the oxygen and hydrogen gases, so as to dispense with the use of bags and pressure boards, in using lanterns? A. There are several varieties of these cylinders; one consists of a cylindrical tank about 2 feet in diameter and 3 feet in hight. Into this is placed in an inverted position a similar vessel, of a few inches smaller in diameter. The apparatus is filled through connections in the upper head of the inner vessel, by displacement of water. Another form is that of a cylinder, constructed of very strong boiler iron, containing only one small opening for connections in the upper head, which is governed by a screw valve. The gas is forced into the tank by means of an air pump, until the pressure per square inch is not less than 200 lbs. The latter are very convenient.

(58) J. P. G. asks: How can I silver the surface of several panes of fine glass, so that they may appear white and brillant? A. See p. 303, vol. 30.

What is the process of canning fish? A. One process consists in placing the fish, after being cleaned, in open vessels, which are then set in a steam chest, and the contents subjected to the action of steam at 212° Fah., for five hours, after which the fish are removed, drained, cooled, and packed with oil in metal boxes of marketable size, which are then closed and soldered, after which the closed boxes are heated by steam from 217° to 230° Fah. for five hours, according to the size of fish. By this method the fish may be preserved without vinegar or spices.

(59) J. C. H. asks: 1. Is the mind located in the brain? A. The mental operations are carried on by corresponding actions in the brain. 2. Can the mind be located at all? Some physiologists hold to the doctrine that the mind is separate and distinct from the soul, while others say the mind is a power with which the soul is endowed. Which is correct? A. These are metaphysical subtleties, not recognized in the treatment of the subject as a part of positive experimental science. 3. When a person is deranged, is it the mind of that person which is impaired, or are the channels through which the mind operates, to receive knowledge from external things, injured? A. Both the centers and avenues of mental impressions and sensations are essential to that healthy and harmonious operation of the mental faculties which characterize a state of mental vigor.

(60) H. J. F. asks: Why do the legs on the bottom of the old fashioned fireplace kettles burn in the middle? A. In order that iron may burn, it is not only necessary that it should be brought to a high temperature, but also that it should come into contact with the oxygen of the air at the same time, and these conditions are only realized in the middle of the leg.

(61) I. W. F. S. asks: Can you inform me of any way of causing fermentation, suitable for baker's yeast, without using stock from previous making? A. Fownes states that if wheat flour is mixed with water into a thick paste, which is to be slightly covered in a moderately warm place, it begins, about the third day, to emit a little gas and a disagreeably sour odor: about the sixth or seventh day the smell changes, much gas is evolved, accompanied by a distinct and agreeable vinous odor; and it is then in a state to excite vinous or panary fermentation, and may be at once used for that purpose, or formed into cakes, dried, and preserved for future use. Wort fermented with it forms a large quantity of yeast.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated:

A. C. S.—It is iron ore, containing a notable quantity of titanium. It cannot at present be smelted with pecuniary advantage.—G. A. F.—A qualitative analysis made upon 100 grains of this pyrrhotine, which closely resembles the niccoliferous pyrrhotine of the Gap Nickel Mine, did not demonstrate the presence of nickel. It should be properly analyzed. A large quantity might show a valuable percentage of nickel.—W. H. McC.—It is a variety of kaolinite; it might be used perhaps, in the manufacture of pottery.—H. L.—It is magnetic pyrites.—G. F. B.—They are tourmaline, muscovite in quartzite, and biotite.—M. W. H.—No. 1 is neither gold nor iron pyrites; it is mica. No. 2 contains 80 per cent of lead.—H. S.—No. 1 is galena and blende. No. 2 and No. 3 are galena. No. 4 is calcite or carbonate of lime. No. 5 is ferruginous quartz. No. 6 is marcasite.—G. L. L.—It is iron pyrites.

E. D. K. asks: How can I dye morocco leather white, and how is the gloss given to morocco and other leather?—S. R. S. asks: How can I pare fruit by heating?—G. W. S. asks: How are broomsticks painted, striped, and waved?—H. K. asks: What preparation is used to put a hard and glossy finish on ax handles?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Automatic Cow Milkers. By J. E. G.
On Scorpions. By D. E. R.
On the American Institute Fair. By L.H.R.
On the Retrogression of the Sun. By C. H. B., and by H. B.
On the late Charles M. Keller. By A. M.
On Steam Engines. By W. P. P.
On Cooking Oatmeal. By W.
On a Calculating Machine. By E. K. W.
On Railroad Employees and their Pay. By B. G. G. J.
On the Phylloxera. By L. W. G.
On a Boiler Explosion. By S. H. H.

Also enquiries and answers from the following:

Q.—W. M. S.—E. B.—G. T.—N. M. L.—R. S. T.—F. U. M.—N. T. D.—R. W.—T. P.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who sells the best stove for heating a workshop? Who manufactures knives, and gold and silver trinkets? Who makes steam indicators? Who publishes a book on making glass? Who makes carbon plates for batteries? Who sells a book on wax fruit and flowers?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

October 6, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Adding machine, E. W. Taylor	155,772
Anemoscope, recording, C. E. Hyde	155,615
Awl, pegging, Fichter & Derheimer	155,645
Axle box, A. Overbagh	155,747
Axles, lathe for turning, Miller & Haines	155,714
Beans, nuts, etc., cleaning, F. Akers	155,693
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Weather strip, A. N. Loper	155,617
Well bull wheel, M. B. McManus	155,740
Wire, making solder, L. McMurray	155,744

APPLICATIONS FOR EXTENSION.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

31,077.—HOISTING DEVICES.—J. J. Doyle. Dec. 28.
31,525.—HOE BLANK MACHINE.—N. Brand. Feb. 10.

EXTENSIONS GRANTED.

30,290.—ORE SEPARATOR.—W. O. Bourne.
30,297.—CAR LIGHT.—R. Cathcard.
30,345.—IRON CHIMNEY TOP.—J. Pettengell.
30,357.—PLOW.—M. G. Slemmons.
30,371.—EXTENSION WASH BENCH.—S. Wiswell.
30,376.—BOOT CUTTING MACHINE.—E. T. Green.

DISCLAIMER.

30,357.—PLOW.—M. G. Slemmons.

DESIGNS PATENTED.

7,786.—GRAVE GUARD.—A. Rank, Salem, Ohio.
7,787.—NECK TRIMMING.—A. A. Rockwell, N. Y. city.
7,788.—KEYS.—A. L. Runyon, New York city.
7,789.—BILLIARD TABLE.—J. E. Came, Boston, Mass.
7,790.—PHOTOGRAPHIC CHAIR.—W. D. Gatchel, Cincin., O.

TRADE MARKS REGISTERED.

2,005.—IRON.—Burgess Works, Portsmouth, Ohio.
2,006.—CALICO PRINTS.—Coffin *et al.*, Philadelphia, Pa.
2,007.—WELT TRIMMERS.—I. A. Dunham, Brockton, Mass.
2,008.—LINIMENT.—Thomas & Co., Brooklyn, N. Y.
2,009.—MEDICINE.—Bliss *et al.*, Des Moines, Iowa.
2,010 & 2,011.—WATCHES.—Courvoisier & Co., N. Y. city.
2,012.—RICE STARCH.—C. R. Fowler *et al.*, N. Y. city.
2,013.—SHEETING.—J. C. Howe & Co., N. Y. city.
2,014.—MEDICINE.—J. S. C. Rowland, Hartford, Conn.
2,015.—GLOVES.—Wirbel *et al.*, New York city.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,

OCTOBER 6 to 8, 1874.

3,905.—J. C. Ford and H. R. Ives, Montreal, P. Q. Improvements on carriage jacks, called "Ford's Improved Carriage Jack." Oct. 6, 1874.

3,906.—F. G. Johnson, Brooklyn, Kings county, N. Y., U. S. Improvements on snow excavators and removers for railways, called "Johnson's Snow Excavator and Remover for Railways." Oct. 6, 1874.

3,907.—A. Rodgers, Muskegon, Muskegon county, Mich. U. S. Improvements on balance slide valves, called "Rodgers' Portable Slide Valve." Oct. 6, 1874.

3,908.—J. D. Fraser, Pictou, Pictou county, Nova Scotia. Improvements on a machine for propelling boats, called "A Vibrating Propeller for Vessels." Oct. 6, 1874.

3,909.—S. B. Peugh, Salem, Washington county, Ind., U. S. Improvements in carriages for plows, called "Peugh's Improved Plow Carriage." Oct. 6, 1874.

3,910.—T. Sandall, Charlottetown, Prince Edward's Island. Improvement on link motions, called "Sandall's Link Motion." Oct. 6, 1874.

3,911.—A. Wyman, Barnston, Stanstead county, P. Q. Improvements on horse hoe, weed cutter, and potato digger combined, called "Wyman's Horse Hoe, Weed Cutter, and Potato Digger Combined." Oct. 6, 1874.

3,912.—F. Leadbeater, Detroit, Wayne county, Mich., U. S. Improvements on grain separators, called "Leadbeater's Improved Grain Separator." Oct. 6, 1874.

3,913.—G. Grimshaw, Minneapolis, Hennepin county, Minn., U. S. Improvements in carriage and wagon springs, called "Grimshaw's Carriage and Wagon Spring." Oct. 6, 1874.

3,914.—J. W. McPherson, McGillivray, Middlesex county, Ont., W. Grundy, and C. Cosens, Lucan, Middlesex county, Ont. Improvement in fences, called "McPherson's Movable Fence." Oct. 6, 1874.

3,915.—F. Weymann, Naples, Italy. Improvements on machines for treating or preparing meal, called "Machine for Preparing Meal." Oct. 6, 1874.

3,916.—W. J. F. Liddell, Milwaukee, Milwaukee county, Wis., U. S. Improvements on horse powers, called "Liddell's Horse Power." Oct. 6, 1874.

3,917.—E. Rowland and G. E. Rowland, Manchester, Lancaster county, England. Improvements in fire bars for furnaces, called "Rowland's Oscillating Furnace Bars." Oct. 8, 1874.

3,918.—O. M. Morse, C. S. Fuller, H. J. Burdick, Oswego, Oswego county, N. Y., U. S., and S. Howes, A. Babcock, N. Babcock, and C. Ewell, Silver Creek, Chatauqua county, N. Y., U. S. Improvements in middlings purifiers, called "Morse's Improved Middlings Purifier, No. 1." October 8, 1874.

3,919.—W. H. Bennett, New York city, U. S. Improvements on a paper file and binder, called "The Yankee Letter File and Binder." Oct. 8, 1874.

Advertisements.

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